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For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1937

02 AERODYNAMICS 1937

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1940

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1941

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1943

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1948

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1948

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1950

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1951

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1952

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 1952

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 1952

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1954

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING 1954

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1955

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION N.A.

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 1956

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 1957

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 1958

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 1959

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 1963

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 1970

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 1972

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) 1974

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 1975

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 1981

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 1987

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 1992

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 1994

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 1998

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 2001

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 2003

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) 2006

43 EARTH RESOURCES 2006
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 2009
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

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48 OCEANOGRAPHY 2030
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51 LIFE SCIENCES (GENERAL) 2031
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52 AEROSPACE MEDICINE 2031
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Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 2057
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 2060
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2060
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2061
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 2062
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2063
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 2067

89 ASTRONOMY 2067
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2067
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2068
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2068
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2069
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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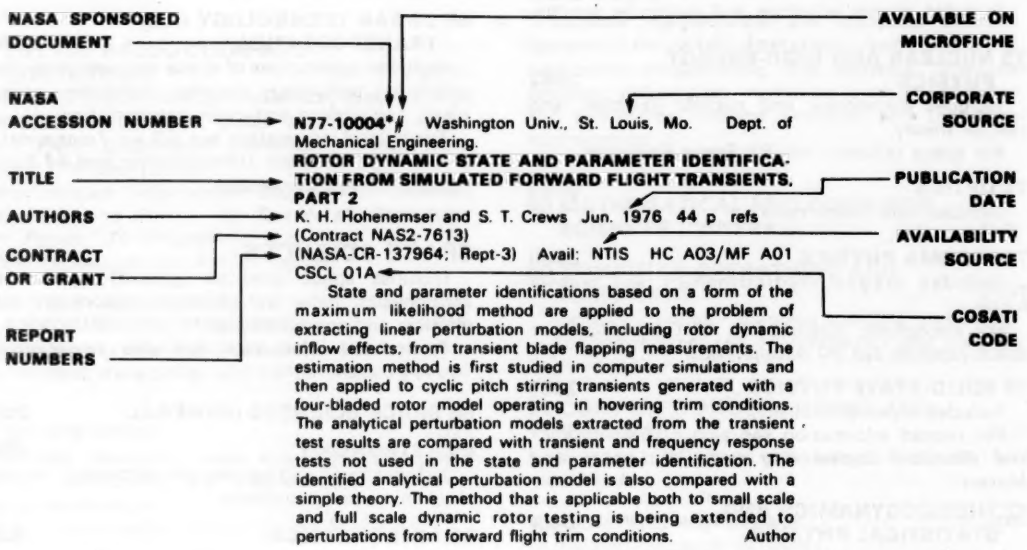
CONTRACT NUMBER INDEX I-65
REPORT/ACCESSION NUMBER INDEX I-69

TYPICAL CITATION AND ABSTRACT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N77-10004*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.
TITLE
ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2
PUBLICATION DATE
AUTHORS
K. H. Hohenemser and S. T. Crews Jun. 1976 44 p refs
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(NASA-CR-137964; Rept-3) Avail: NTIS HC A03/MF A01
CSCL 01A
COSATI CODE
State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects – not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, MECHANISMS OF EXHAUST POLLUTANT AND PLUME FORMATION IN CONTINUOUS COMBUSTION
G.S. SAMUELSEN, Univ. of California, Graduate School, *Irvine, California* 92664 (DF039370; AF-AFOSR-2710-74)

AF function - weapon delivery and defense, advanced air-breathing engines. Deficiency - insufficient understanding of relative influence of physical and chemical processes involved in high-speed turbulent reacting flows and lack of realistic guidelines for predicting exhaust gas pollutants and plume formation. Objective - to clarify the relative influence and to formulate realistic analytical representation of the mechanisms and processes responsible for pollutant production and plume formation in jet engine continuous combustors. How work contributes - will provide additional understanding and realistic modeling of turbulent reactive flow fields not now available and contribute to establishing guidelines and techniques for reducing adverse environmental effects and controlling plume signatures in jet engine combustors by control and modification of combustion dynamic processes.

Studies of mechanisms responsible for pollutant and plume formation in jet engine continuous combustors will be carried out. Experiments will be conducted with both nonreacting and reacting flows in an opposed-reacting jet (ORJ) continuous flow facility under conditions closely simulating basic flow characteristics of gas turbine engines. Theoretically predicted profiles of flow properties will be compared with experimentally determined profiles to evaluate numerical techniques used to solve governing differential equations describing the ORJ and associated models of turbulence for nonreacting flows and coupled models of turbulence and chemical kinetics for reacting flows. Deficiencies in present models will be identified and used to formulate a refined theoretical model accurately predicting formation of combustion-generated pollutants. Parametric studies will be performed to identify relative contribution of transport mechanisms, chemical kinetics and system parameters to pollutant formation. Particulate formation and luminosity related to alternate fuels will be studied. The potential of utilizing the ORJ in real gas turbine combustor applications (e.g., fuel injection, flame stabilization) to reduce pollutant formation by promoting lean combustion will also be investigated.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg 410, Bolling AFB, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0002, INVESTIGATION OF AN IMPROVED THEORY FOR THE ANALYSIS OF NATURAL AND MAN-MADE LAYERED STRUCTURES
P. SEIDE, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (NSG 1401)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0003, STUDIES OF THE EFFECTS OF FORWARD FLIGHT ON AIRCRAFT NOISE AND ITS SIMULATION
K. KARAMCHETI, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NSG 2215)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0004, MEASUREMENTS IN TURBULENT BOUNDARY LAYERS WITH SLOT INJECTION OF HELIUM
P.A. LIBBY, Univ. of California, School of Engineering, *San Diego, California* 92038 (NSG 1386)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0005, STUDY TO DEVELOP COMPUTATIONAL METHODS FOR TURBULENT REACTION AND FOR TURBULENT MIXING IN CURVED STREAMLINES
I.I. GLASS, Univ. of Toronto, *Toronto, Ontario, Canada* (NAS 1-14843)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0006, FLUSH MOUNTED SEPARATION DETECTOR DEVELOPMENT, ANALYSIS AND OPTIMIZATION OF PERFORMANCES
A. BROSH, Tel Aviv University, *Tel Aviv, Israel* (NSG 7311)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0007, ANALYTICAL MODELING OF NOISE SOURCE IN A MOVING JET
P.L. CHOW, Wayne State University, Graduate School, *Detroit, Michigan* 48202 (NSG 1330)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0008, PROPELLER PROPULSION INTEGRATION
E.J. CROSS, Mississippi St. University, School of Engineering, *Mississippi State, Mississippi* 39762 (NSG 1402)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0009, STABILITY ANALYSIS OF WIND TURBINES WITH LONG, FLEXIBLE BLADES
K.R. KOZA, Univ. of Toledo, Graduate School, *Toledo, Ohio* 43606 (NSG 3139)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0010, INVESTIGATION OF THE AERODYNAMICS FOR PREVENTING AIRCRAFT STALL AND THE DEVELOP-

MENT OF TECHNOLOGY FOR STALL-PROOF GENERAL AVIATION AIRCRAFT
H.L. CHEVALIER, Texas A & M University System, School of Engineering, *College Station, Texas* 77843 (NSG 1407)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, SPACELAB MISSION 1 EXPERIMENT 24 - AN IMAGING SPECTROMETRIC OBSERVATORY FOR SPACELAB 1
UNKNOWN, Univ. of Michigan, Graduate School, *Ann Arbor, Michigan* 48104 (NAS 8-32569)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

2.0002, TECHNICAL OPERATIONS SUPPORT FOR THE SPACECRAFT LABORATORY
T. NODA, New Mexico State University, Graduate School, *Las Cruces, New Mexico* 88001 (NAS10-9115)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, DEVELOPMENT OF SURFACES OPTICALLY SUITABLE FOR FLAT SOLAR PANELS
D. DESMEDT, Univ. of Alabama, Graduate School, *Tuscaloosa, Alabama* 35401 (NAS 8-32481)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0002, A STUDY OF PROCESSING PARAMETERS FOR NON-METALLIC COMPOSITES
A.C. LING, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2209)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0003, KINETIC EFFECTS OF POLYRIBONUCLEOTIDES ON AMINO ACID CONDENSATION ON HYPOHYDROUS CLAY SURFACES
D.H. WHITE, Univ. of Santa Clara, Graduate School, *Santa Clara, California* 95053 (NCA 2-685708)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0004, MATRIX-ISOLATION-INFRARED AND RAMAN STUDIES OF SHORT-RANGE INTERMOLECULAR INTERACTIONS
J.H. HALL, Morehouse College, School of Arts & Sciences, *Atlanta, Georgia* 30314 (NSG 8049)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0005, LOCAL ATOMIC ARRANGEMENTS IN ALLOYS AND INTERMETALLICS
J.B. COHEN, Northwestern University, School of Technology, *Evanston, Illinois* 60201 (DMR76-80662)

This is a continuation of research employing X-ray and neutron diffraction techniques to characterize atomic arrangements in metallic materials associated with important dynamical lattice events. Among the areas under investigation are: 1. heterophase fluctuations in alloys which undergo phase transitions; 2. kinetics of order-disorder reactions; 3. premonitory effects prior to the first-order reaction in Cu3Au to ascertain if these are associated with anharmonic effects and possible relationship to other kinds of first-order transitions; 4. diffuse neutron scattering from age-hardened Al-Cu alloys to define quantitatively the internal stucture of a Gunier-Preston zone by computer simulation with measured short-range order parameters and displacements; 5. local atomic arrangements in ternary Heusler alloy systems which exhibit different ordering temperatures; and 6. detailed determination of the defect state in Ni1 plus or minus x Al1 plus or minus x to obtain the Warren short-range order parameters and with computer simulation, the details of non-random arrangement. Lastly, a new method of diffuse scattering analysis is under study which could, for the first time, yield the separate mean displacement of AA and BB pairs in a concentrated binary alloy, and allow computer simulation of these displacements. This is a renewal of NSF Grant DMR73-07549-A01.

SUPPORTED BY U.S. Natl. Science Foundation

3.0006, COLLISIONAL ROTATIONAL EXCITATION AND MOLECULAR SPECTROSCOPY WITH A VISIBLE LASER FLUORESCENCE DETECTOR
P.J. DAGDIGIAN, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (CHE75-05625 A02)

Dr. Dagdigian plans to extend the use of the tunable laser fluorescence detector to the study of nonreactive inelastic collisional processes. He plans in particular to measure total collisional cross sections delta j, j' for rotational excitation from an initial j level to a final j' level. Because this detector is sensitive to the internal (v, j) state of the detected molecule, the experiment will provide some simplification over a previous molecular beam experiment which used a hot-wire detector. In addition, it can provide a panoramic view of the inelasticity since, unlike this previous experiment, large delta j changes are observed as easily as small delta j transitions. Dr. Dagdigian will concentrate on the study of the simple molecule LiH in order to facilitate comparison with theoretical calculations. Additional experiments will be directed toward the study of more complicated molecules such as formaldehyde, which has astrophysical significance. In addition, the apparatus will be used to measure by molecular beam electric deflection dipole moments of molecules which are difficult to observe with a hot-wire or mass spectrometer detector because of interference from impurity molecules in the beam. Initial experiments will be directed to the study of the alkaline earth monohalides in order to test further the applicability of an ionic model to these 'one-electron' molecules. Studies will continue on the production and refocusing of other molecules of interest.

SUPPORTED BY U.S. Natl. Science Foundation

3.0007, RAMAN SPECTROSCOPY OF COSMIC ICES AND PLANETARY ATMOSPHERES
R.J. KHANNA, Univ. of Maryland, School of Agriculture, *College Park, Maryland* 20742 (NSG 5172)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0008, RESEARCH OF ADVANCED MATERIALS FOR THE DEVELOPMENT OF A FIRE-SAFE AIRCRAFT SEAT
G.C. TESORO, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 2204)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0009, FLUORIDE MATERIALS FOR HIGH PEAK POWER LASERS
R.C. FOLWEILER, Sanders Associates Inc., *Nashua, New Hampshire* 03060 (E(11-1)-2921)

The program is intended to discover and develop fluoride optical materials with a low non-linear index of refraction (n2) combined with good optical, plus electrooptical or magnetooptical properties. Current laser fusion programs use silicate-based glass components for the laser train, including 1) the active laser material, 2) Faraday rotators that prevent feedback, and 3) optical elements. These materials exhibit relatively high non-linear index of refraction (n2), where n equals n zero plus n2E to the 2nd power. The electric field, E, is of sufficient magnitude that the index of refraction is measurably increased by the non-linear term, leading to undesirable self-focusing within the optical train, distorting the wave front and thereby limiting the energy density delivered to the target.

Fluoride materials as a class have lower values of n2, as well as n0, decreasing the effects of self-focusing. Fluoride materials, with suitable sites for substitution of rare-earth ions, are of substantial interest for both the laser material and Faraday rotators. The laser material, Nd3 plus in LiYF4, very closely matches the desired wavelength of future-generation amplifier materials, such as phosphate glasses and fluoroberyllate glasses, since it lases at 1.053 microns or 1.047 microns, depending on crystalline orientation. This program includes the development of crystal growth techniques and growth of suitably sized materials for laser evaluation.

The program includes a search for new crystalline fluoride materials, with an emphasis on materials such as KY3F10, a cubic material, and its rare-earth substituted analogs, such as KTb3F10, which are expected to provide high specific rotary power and low values of n2.

The single crystals prepared under the program, both at Sanders Associates, Inc., and its subcontractor, Massachusetts Institute of Technology, will be grown in digital computer-controlled facilities providing continuous monitoring and long-term stability necessary for crystal growth. The crystals will be grown by either the Czochralski or top seeded solution techniques, as appropriate; an inert atmosphere will be used. Chemical purification techniques, such as solvent extraction and membrane filtering, will be applied as needed.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - L.F.D.

3.0010, APPLICATIONS OF MICRODYNAMICS AND LATTICE MECHANICS TO PROBLEMS IN PLASTIC FLOW AND FRACTURE

J.C. BILELLO, State University of New York, School of Engineering, *Stony Brook, New York* 11790 (EY-76-S-02-3476)

The energetics of cleavage in tungsten and molybdenum single crystals will be studied with emphasis on the structural nature of the spark discharge precursor crack used to create a critical Griffith flaw as well as on the role of microplastic relaxation in influencing measured surface energies. The quantitative features of the precursor crack-tip zone will be investigated via etch-pit mapping observations on the side surfaces of samples and also by stereo Scanning Electron Microscopy (SEM) fractography. It is anticipated that these observations will provide a measure of the crack-tip radius and knowledge of the magnitude of the forces necessary to restart an 'arrested' microflaw in a crystalline solid. Other studies will examine the factors controlling plastic microstrain for nominally pure molybdenum crystals and for identical samples with controlled oxygen interstitials. These microstrain experiments on molybdenum should provide the information necessary for understanding the plastic relaxation accompanying cleavage in such crystals. Finally work is also proposed for assessing the cleavage energy of solid solution alloy Nb-Mo single crystals over their entire range.

RESULTS: Research in progress has concentrated on experimental studies of the temperature dependence of crack propagation in molybdenum single crystals, on a theoretical investigation of screw dislocations via lattice dynamic methods and on the crystal growth of niobium- molybdenum alloys. Cleavage observations at 77 degrees K for (100) oriented molybdenum crystals revealed significant plastic relaxation at the crack-tip. Raising the temperature to 298 degrees K causes 'slow' crack growth to occur, but only when the macroscopic proportional limit is exceeded. The implications of these findings with respect to cleavage energetics are discussed. Lattice dynamics calculations on a model crystal have determined the local optical mode frequencies and inelastic neutron scattering cross section for screw dislocation arrays. A method of assessing the screw dislocation core energy from such data is indicated. Finally a series of Nb-Mo alloy crystals of homogeneous composition and controlled microstructure has been produced.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

3.0011, DENTRITIC SOLIDIFICATION AT SMALL SUPERCOOLING

M.E. GLICKSMAN, Rensselaer Polytechnic Inst., School of Engineering, *Troy, New York* 12181 (NAS 8-32425)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0012, CHARACTERIZATION OF STRUCTURE OF A POLYMER WITH MAGNETIC RESONANCE SPECTROSCOPY

W.M. RITCHEY, Case Western Reserve Univ., Graduate School, *Cleveland, Ohio* 44106 (NSG 3142)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0013, METALLIC SUPERCONDUCTING POLYMER NITRIDE AND RELATED SYSTEMS

M.M. LABES, Temple University, School of Liberal Arts, *Philadelphia, Pennsylvania* 19122 (DMR77-01055)

The first metallic, superconducting polymer polysulfur nitride, (SN)x, has been studied in considerable detail during the last few years. Polymorphic forms of (SN)x have recently been prepared in which the bond distances, angles and interchain interactions vary. Under the present grant, the properties of these polymorphs are examined in detail to elucidate structure-property relationships. Crystal growth of these polymorphs and of normal (SN)x is undertaken in both the vapor and solution phases. The incorporation of (SN)x chains into clathrate structures is investigated in attempts to examine both the dimensionality requirements of superconductivity in (SN)x and to achieve a model for an excitonic superconductor.

This is a continuation of research supported under DMR74-24202. This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. Natl. Science Foundation

3.0014, MICROWAVE-OPTICAL DOUBLE RESONANCE SPECTROSCOPY

D.W. PRATT, Univ. of Pittsburgh, School of Natural Sciences, *Pittsburgh, Pennsylvania* 15213 (EY-76-S-02-3435)

Several experimental techniques, including EPR, ODMR, MIDP, MWFP, LAC/CR, XPS, NMR and optical spectroscopy, are being used to study the static and dynamic properties of transient species (electronically excited states, thermally accessible excited states, and free radicals) which are produced on irradiation of organic solids with high-energy photons. Particular emphasis is being placed on problems of significant theoretical interest, such as the determination of the absolute signs of the zero-field parameters of pi, pi*, and n,pi* triplet states, the measurement of the hyperfine and quadrupole tensors of interacting nuclei in photochemical prototypes such as 3(n,pi*) benzophenone; the phenomena of second-order spin-orbit coupling, level anticrossing, and cross-relaxation; isotope effects on the magnetic and optical properties of excited triplet states; the determination of singlet-triplet energy differences in small molecules; and the conformational properties of small rings and free radicals exhibiting hindered motions. A large part of our work in the near future will be devoted to the development of optically detected microwave pulse methods for observing free precession and spin echoes in para-magnetic excited states and exploring the dynamics of photochemical reactions.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

3.0015, GROWTH, PERFECTION, AND CHARACTERIZATION OF TRIGLYCINE SULFATE - A MODEL FOR ZERO GRAVITY GROWTH
W.B. WHITE, Penn. State University, School of Earth & Min. Sci., *University Park, Pennsylvania* 16802 (NSG 1387)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0016, PROCESS FEASIBILITY STUDY IN SUPPORT OF SILICON MATERIAL TASK
C. YAWS, Lamar University, Graduate School, *Beaumont, Texas* 77704 (954343)

The Contractor shall perform a program of investigations and analyses of processes for the low-cost, high-volume production of silicon suitable for solar cells. These processes shall include, but not necessarily be limited to, those involving the reduction of tetraiodosilane by hydrogen and the reduction to tetrachlorosilane by zinc. Other processes to be considered shall be determined by the Jet Propulsion Laboratory. The objective of this program shall be to evaluate the commercial practicability of these processes.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - S.E.D.

3.0017, X-RAY STUDIES OF THE BEHAVIOR OF TITANIUM AND MOLYBDENUM FILMS ON SILICON SUBSTRATES
C.R. HOUSKA, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (DMR75-17201)

This research will be a study of the kinetics of silicide formation in thin films of Ti/Si and Mo/Si, an area of importance in development of solar energy devices. The kinetics will be investigated at about one-half the melting points of the compounds MoSi2 and TiSi2. Specimens of silicon will be sputter-etched to assure the complete removal of native oxide films prior to deposition of titanium or molybdenum. An accurate determination of the compound phase thickness as a function of time will be made using X-ray diffraction methods, which include determining preferred orientation of the growing phases. X-ray line broadening will be measured to determine grain size and the presence of other defects which might form.

Quantitative X-ray measurements will be carried out on two diffractometers. One will be a modification of a Schulz texture diffractometer giving high intensities and very low background; the second will make use of a high-resolution arrangement for line broadening measurements. Auger spectroscopy or ion scattering will be used for depth profiling to provide complementary data on the final composition profiles.

SUPPORTED BY U.S. Natl. Science Foundation

3.0018, COMPUTATIONAL SOLUTION OF ATMOSPHERIC CHEMISTRY PROBLEMS
G.L. GOGLIA, Old Dominion University, School of Engineering, *Norfolk, Virginia* 23508 (NSG 1393)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, OPTICAL SURFACE DAMAGE FROM REENTRANT GASES ON SPACE TRANSPORTATION SYSTEM
R. MCNUTT, Athens State College, Undergraduate School, *Athens, Alabama* 35611 (NAS 8-32483)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0002, CLOSURE RELATIONS IN FLUID MECHANICS
D. BAGANOFF, Stanford University, School of Engineering, *Palo Alto, California* 94305 (ENG75-15230)

Purpose of this research project is to apply a closure scheme for the solution of the Boltzmann equation for shock-wave structure. Particular attention will be focused on implications of the operations of straining and shifting in velocity space and the physical consequences of the continuum interpretation of these closure relations. Complete shock-wave structure computations will be carried out starting with the 13-moment equations. Direct comparisons will be made of the fluid dynamic variables with purely numerical solutions to the same shock structure problem.

SUPPORTED BY U.S. Natl. Science Foundation

4.0003, DEVELOP ULTRASONIC INDICES FOR SPACE SHUTTLE PASSENGER SELECTION
UNKNOWN, Stanford University, Graduate School, *Palo Alto, California* 94305 (NSG 2214)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0004, MANATEE TRACKING PROJECT - DEVELOP A CONCEPT OF AN AUTOMATIC TRACKING SYSTEM TO DETERMINE THE LOCATION AND MOVEMENTS OF MANATEES
R.C. MICHELSON, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (NAS10-9097)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0005, DYNAMIC LOAD AND LUBRICATION OF SPIRAL BEVEL GEARS
H.S. CHENG, Northwestern University, Technological Institute, *Evanston, Illinois* 60201 (NSG 3143)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0006, TWO-DIMENSIONAL SHOCK DIFFRACTION
D.A. ANDERSON, Iowa State Univ. of Sc. & Tech, School of Engineering, *Ames, Iowa* 50011 (NCA 2-340704)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0007, OPTIMAL NODAL POINT DISTRIBUTION FOR FINITE DIFFERENCE ERROR CONTROL
B.L. PIERSON, Iowa State Univ. of Sc. & Tech, School of Engineering, *Ames, Iowa* 50011 (NCA 2-340705)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0008, METAL-OXIDE-SEMICONDUCTOR SOLAR CELL
H.C. LIN, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (ENG76-09933)

An investigation will continue into the use of metal-insulator-semiconductor structures in the fabrication of solar cells. The effort will be directed towards demonstrating experimentally that the performance of such structures can approach that of conventional p-n junction-type cells. One area to be emphasized in the study is the use of transparent conductive electrodes to reduce optical reflection and surface resistive losses. Also to be investigated is the effect on cell performance of increasing surface state densities and varying processing procedures for insulator growth.

This is a continuation of research previously supported under NSF grant ENG-7419310.

SUPPORTED BY U.S. Natl. Science Foundation

4.0009, HIGH-SPEED CORRELATION ALGORITHMS FOR MASSIVELY PARALLEL MACHINES
J.H. MCCLELLAN, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (NSG 5157)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0010, FEASIBILITY STUDY FOR CONDUCTING EXPERIMENTAL RESEARCH IN CURRICULUM SHARING
L. WILLIAMS, North Carolina A & T St. Univ., School of Engineering, *Greensboro, North Carolina* 27411 (NAS 5-24101)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0011, CONTAMINATION CONTROL STUDY
D.L. KINSER, Vanderbilt University, School of Engineering, *Nashville, Tennessee* 37203 (NAS 8-32437)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0012, A FUNDAMENTAL STUDY OF LIQUID SPRAY EVAPORATION AT A HEATED SURFACE
F.A. WIERUM, Rice University, School of Engineering, *Houston, Texas* 77001 (NAS 9-15274)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0013, COMPUTATION OF MINIMUM-NOISE AIRCRAFT LANDING TRAJECTORIES
G.E. COOK, Univ. of Virginia, School of Engin. & Appl. Sci., *Charlottesville, Virginia* 22903 (NSG 1388)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0014, A STUDY OF THE INSTRUMENT FLIGHT RULES HELICOPTER SYSTEM
I.D. JACOBSON, Univ. of Virginia, School of Engin. & Appl. Sci., *Charlottesville, Virginia* 22903 (NSG 1399)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0015, STABILITY OF ELECTRODE SYSTEMS FOR ELECTROCHEMICAL COLIFORM DETECTORS
G.E. STONER, Univ. of Virginia, Graduate School, *Charlottesville, Virginia* 22903 (NSG 1406)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0016, SPACE PROCESSING APPLICATIONS ROCKET - CHARGED WATER-DROP OSCILLATIONS
C. SAUNDERS, Univ. of Wyoming, Graduate School, *Laramie, Wyoming* 82070 (NAS 8-32486)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, BUILDING AND OBSTACLES WAKES
E. LOGAN, Arizona State University, School of Engin. Sciences, *Tempe, Arizona* 85281 (NAS 8-32357)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0002, BUILDING A MODEL FOR A REMOTE-SENSING TECHNOLOGY TRANSFER PROGRAM
D.B. HANKINS, Calif. State Univ. & Colleges, Graduate School, *Arcata, California* 95521 (NSG 2212)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0003, DETERMINING THE USEFULNESS OF REMOTE SENSING FOR ESTIMATING AGRICULTURAL WATER DEMAND IN CALIFORNIA
R.N. COLWELL, Univ. of California, School of Natural Resources, *Berkeley, California* 94720 (NSG 2207)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0004, METEORITIC BISMUTH AND LEAD-208 MICRO DISTRIBUTIONS
D.S. WOOLUM, Calif. State Univ. & Colleges, School of Math. Sci. & Engin., *Fullerton, California* 92631 (NSG 7314)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0005, STRATOSPHERIC STUDIES - HIGH-ALTITUDE POLLUTION PROGRAM
F.M. LUTHER, Univ. of California, Lawrence Livermore Laboratory, *Livermore, California* 94550 (DOT-FA76NAI-653)

The objective of this research project is to develop an improved capability for assessment of the environmental effects of aerospace operations in the stratosphere using numerical simulation. Areas of research include photochemical kinetics, transport-kinetics modeling using one and two-dimensional models, and solar and longwave radiative transfer. This project builds upon a numerical modeling capability developed at LLL during the Climatic Impact Assessment Program (1972- 1975). Engine effluents such as NOx and H2O affect the chemical composition of the stratosphere, reducing ozone. SO2 forms sulfate aerosols which affect the earth's radiation balance, which is also affected by changes in O3, NO2, and H2O. Emphasis is on the refinement and improvement of our modeling capability with the objective of reducing uncertainties. We are considering the net effect of the simultaneous emission of pollutants as well as the effect of each pollutant individually.

RESULTS: There have been many changes to the model chemistry as our understanding of reaction rates, chemical schemes, and absorption cross sections has improved. Detailed radiative transfer calculations have led to refinements in the transport-kinetics model such as including temperature feedback and multiple scattering effects. Sensitivity studies have shown that the uncertainty in predicted reductions of ozone are greater than previously estimated due to uncertainties in key chemical reaction rates.

SUPPORTED BY U.S. Dept. of Transportation - O.E.Q.

5.0006, THEORETICAL STUDIES OF MOON PLASMA INTERACTIONS
G. SCHUBERT, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (NSG 7315)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0007, ANTARCTIC AURORAL PHOTOMETRY
S.B. MENDE, Lockheed Missiles & Space Co., *Palo Alto, California* 94304 (DPP 76-81106)

A six-channel meridian-scan auroral photometer, which offers a high potential of producing otherwise unobtainable information about the solar-terrestrial relationship, will be operated at South Pole Station to collect auroral data. South Pole, with its 24 hours/day dark period during the austral winter, is a unique location from which to make these measurements. During average solar activity, Pole is geomagnetically poleward of the night-side aurora but slightly equatorward of the day- side aurora. At solar

active periods the entire auroral oval moves equatorward, and Pole is ideally situated for investigating the day-side cusp. The photometer will monitor precipitating particles of various types and energies; it will also monitor the plasma sheet and the data will be used to search for a temporal relationship between the thinning of the plasma sheet and substorm events. The data will be studied to delineate the behavior of the day-side auroral region and to understand cusp region precipitation. Simultaneously, a two-channel auroral photometer will be operated at Siple Station, Antarctica, to study auroral activity caused by (Siple transmitter) Artificially Stimulated Emissions.

One technician will winter over at South Pole and one at Siple during 1978.

SUPPORTED BY U.S. Natl. Science Foundation

5.0008, CRATER MODIFICATION BY GRAVITY
H.J. MELOSH, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (NSG 7316)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0009, FIELD SAMPLING AND DATA ANALYSIS FOR RADAR SOIL MOISTURE TEST
J.E. ESTES, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (NSG 5170)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0010, NUTATION AND POLAR MOTION OF THE EARTH
M.L. SMITH, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (NSG 7319)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0011, GAMMA-RAY SPECTROMETRY IN URANIUM EXPLORATION
J.S. DUVAL, U.S. Dept. of the Interior, Geological Survey, *Denver, Colorado* 80225 (9790-01708)

STATES TO WHICH PROJECT PERTAINS: Texas, Wyoming.

Objectives to be pursued in the current fiscal year include: development of alternate ways to present aerial radiometric data such that the maximum amount of information can be extracted, investigate the use of specialized statistical analysis tools in an effort to improve the interpretation of radiometric data, establish the usefulness of large-volume plastic scintillators for the collection of high-quality gamma-ray spectrometric data, and complete analysis of aerial surveys from Texas and Wyoming.

With the availability of high-quality aerial spectrometric data being obtained by ERDA, sophisticated analysis and presentation techniques can be applied to the data and the information content of the data can be greatly improved. This project is investigating the use of image processing techniques as well as statistical analysis methods. These special techniques offer the promise of enabling the detection of subtle geologic and geochemical variations that heretofore could not be seen in the radiometric data.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0012, RESEARCH - AIRBORNE
F.C. FRISCHKNECHT, U.S. Dept. of the Interior, Geological Survey, *Denver, Colorado* 80225 (9780-00353)

STATES TO WHICH PROJECT PERTAINS: Colorado, Missouri.

A tail boom installation will be designed, fabricated and installed on a Porter aircraft which will permit installation of existing VLF antennas.

Experimental surface EM measurements will be made over a deep ore body of the Mississippi Valley type.

Problems related to the detection of deep ore bodies will be carried out by scale model studies.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0013, OPTIMUM BAND PASSES FOR REMOTE SENSING
G.R. HUNT, U.S. Dept. of the Interior, Geological Survey, *Denver, Colorado* 80225 (9790-01863)

The project plans are to: a) modify an aircraft-borne scanner to operate in the 1.5 to 2.5 microns region and to record images with it of altered and unaltered terrain; b) modify a Fourier-transform spectrometer for use as a limited field instrument to operate in the 1 to 5 microns range; c) Record laboratory spectra in the 3 to 40 microns region of rocks and soils to establish the optimum information regions; d) establish design criteria for a portable field spectrometer.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0014, STRUCTURAL AND ENGINEERING EVALUATION OF LINEAMENTS
D.W. OLEARY, U.S. Dept. of the Interior, Geological Survey, *Denver, Colorado* 80225 (9790-01695)

STATES TO WHICH PROJECT PERTAINS: Missouri, Arkansas, Illinois, Indiana, Kentucky, Tennessee, Maine.

Lineaments mapped from SLAR images of the Mississippi embayment will be mapped at 1:600,000 and 1:480,000 and reduced and compiled at 1:250,000. The lineament population will be statistically summarized and classified to determine fundamental characteristics of terrain patterns within the upland part of the embayment, with respect to high- order drainage basins, regional slopes, and regional lithologies. Non- systematic lineaments will be segregated from the systematic patterns for individual study. Local influences on the patterns will be evaluated and lineaments will be correlated with mapped geology and geophysics.

The validity of microwave radiometry as a technique for detecting lineaments in alluviated areas will be tested and evaluated, based on this year's survey results and on the known geology of the study sites. Results will be published.

Lineament studies in Maine will combine reconnaissance field work with detailed mapping of lineaments from Landsat images and high- altitude aerial photos. Landscape patterns in terrains bounded by major lineaments will also be studied and appropriate geomorphic parameters will be determined to establish quantitative distinctions in terrain patterns.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0015, LIGHT AIRCRAFT PHOTOGRAPHY AND MAPPING RESEARCH
R.L. PARKER, U.S. Dept. of the Interior, Geological Survey, *Denver, Colorado* 80225 (9350-00800)

This project seeks to develop techniques of aerial photography using small-format cameras, and of aerial geologic reconnaissance in order to assist geologic mapping and mineral resource investigations. Currently a T-41B is being used to fly 70-mm cameras for both vertical and oblique photography using color and black-and-white films. Projects supported are primarily resource studies in the Rocky Mountain states.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0016, TECHNIQUES OF GEOCHEMICAL, GEOPHYSICAL, & GEOLOGICAL EXPLORATION IN THE SONORAN ENVIRONMENT, WITH EMPHASIS ON THE SEARCH FOR COPPER
P.K. THEOBALD, U.S. Dept. of the Interior, Geological Survey, *Denver, Colorado* 80225 (9330-01366)

STATES TO WHICH PROJECT PERTAINS: Sonora, Mexico; Arizona; New Mexico.

Current plans are to complete the analysis of approximately 900 stream sediment, panned concentrate, water, soil, and plant samples collected last fall in Sonora, Mexico. The heavy mineral samples will be split into three magnetic fractions and the soils will be split into three size fractions. The mesquite samples will be divided into stems and leaves before ashing. The results of the analytical work will be added to last year's results in the RASS

computer system and element distribution maps for the entire study area will be prepared for interpretation of anomalies and in conjunction with refined regional gravity, aeromagnetic, and LANDSAT data will be used for choosing areas within the study area for more detailed sampling, geophysics, and mapping. Field trips to Sonora in April and September 1977 will concentrate on this more detailed work.

The detailed geophysical investigations in the specified areas will include gravity and magnetic profiles suitable for computer model studies. In particular, geoelectrical techniques will be applied over both pediment and volcanic target areas. Dipole resistivity soundings will be used to make depth and configuration of high-resistivity crystalline rocks beneath pediments. Experiments will be made with time domain IP (induced polarization) methods and possibly complex resistivity for direct detection of polarizing material and alteration that might be related to ore deposits. In volcanic covered areas, MT (magnetotelluric) surveys will be used to map thicknesses of volcanic cover and possible detection of conductors beneath the volcanics.

In remote sensing, research will continue on statistical procedures and refinement of the lineament map through analysis of better LANDSAT images than previously used. Also the hydrothermal alteration map will be greatly refined and improved through the application of better digital image processing techniques recently developed by Raines.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0017, THEORETICAL SIMULATIONS OF SOLAR SPECTRA IN THE MIDDLE ULTRAVIOLET AND VISIBLE FOR ATMOSPHERIC TRACE CONSTITUENTS MEASUREMENTS
A. GOLDMAN, Univ. of Denver, Graduate School, *Denver, Colorado* 80210 (NSG 1405)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0018, DEVELOPMENT OF A WINTER WHEAT ADJUSTABLE CALENDAR MODEL
J.R. BAKER, Fort Lewis College, Undergraduate School, *Durango, Colorado* 81301 (NAS 9-15276)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0019, VEGETATION AND HAZARD CLASSIFICATION IN THE MOUNTAINS USING LANDSAT (ERTS) IMAGES & AMS ELEVATION
E. MAXWELL, Colorado State University, Agric. Experiment Station, *Fort Collins, Colorado* 80521 (0069024; COL00357)

OBJECTIVE: Develop the capability for combining digitized elevation data (AMS tapes) with LANDSAT images for improved computer classifications. Use vegetation models (slope, aspect, climate, soil type variables) to improve computer classification of vegetation types from LANDSAT images. Classifications will be attempted for vegetation types and hazard classes.

APPROACH: A computer program will be used to merge LANDSAT & AMS elevation data. The TOPOGO Program will then be used to compute slope- aspect data for each ERTS Pixel. Several methods for using slope-aspect data to improve classification will be investigated. We will use known characteristics of vegetation occurrence as a priori information to weigh the probability of a given vegetation type classification. Several quadrangles will be chosen for classification of the vegetation types and hazard classes noted. Classification maps will be produced at 1:24,000 scale.

PROGRESS: Work begun under Project 318 has been completed. Ecosystem classification maps at 1:24000 scale have been prepared from ERTS data. Specifically, maps have been completed for the Red Feather Lakes, Pingree Park and Eaton Reservoir quadrangles (all in Colorado). These initial results appear to be quite good and are being checked (in cooperation with the Colorado State Forest Service) for accuracy. The spectral signatures of several forest ecosystems have been positively shown to be a function of slope and aspect. This indicates that our plan to use elevation, slope and aspect data to improve classification accuracy should be successful. This will be attempted during the coming months.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0020, DEFINITION OF AN OPERATIONAL SYSTEM FOR MONITORING OCEAN WASTE DISPOSAL IN THE NEW YORK BIGHT
V. KLEMAS, Univ. of Delaware, School of Marine Studies, *Lewes, Delaware* 19958 (NSG 1398)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0021, MEASUREMENT OF OCEAN SURFACE MICROSTRUCTURE IN A WIND GENERATED WAVE FIELD
J. WU, Univ. of Delaware, School of Engineering, *Newark, Delaware* 19711 (NAS 6-2820)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0022, CONTINENTAL AND MARINE AEROSOLS OVER THE NORTHERN EQUATORIAL ATLANTIC OCEAN DURING GATE
J.M. PROSPERO, Univ. of Miami, Graduate School, *Miami, Florida* 33149 (ATM76-01195 A01)

The objectives of this research program continue to be: (1) To determine the three-dimensional geographical distribution of aerosols and to relate this distribution of macro-, meso- and micro-scale meteorological parameters, (2) To determine the chemical, physical (size), mineralogical and morphological characteristics of the aerosols, (3) To identify the source areas of the mineral aerosol component and the meteorological and climatological factors affecting the generation and transport of dust from the source areas.

The aerosol data were collected during the GARP Atlantic Tropical Experiment (GATE) from four land stations, seven ships, and two aircraft. This observation network, established by the P.I., was designed to capture aerosols released in the course of several Saharan air outbreaks during GATE. These 'dust clouds' traveled great distances, being observed as far west as the P.I.'s most westerly land stations, Barbados and Miami.

This work is important on its own right for climate studies. In addition it is a vital component of the GATE radiation subprogram which uses aerosol and turbidity data as model input.

SUPPORTED BY U.S. Natl. Science Foundation

5.0023, COST-BENEFIT ANALYSIS OF GEORGIA NATURAL RESOURCE INVENTORY SYSTEM
R.P. ZIMMER, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (NAS 9-15283)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0024, DEVELOPMENT OF SCALING LAWS FOR GRANULAR MATERIALS DISCHARGED FROM AN AGRICULTURAL AIRPLANE
A.I. ORMSBEE, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (NSG 1400)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0025, REMOTE SENSING OF OCEANS
R.K. MOORE, Univ. of Kansas, School of Engineering, *Lawrence, Kansas* 66044 (NSG 1397)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0026, DEVELOPMENT AND APPLICATION OF PHOTOGRAPHIC TECHNIQUES OF REMOTE SENSING
G. COOPER, Univ. of Maine, Agric. Experiment Station, *Orono, Maine* 04473 (0071745; ME08494)

OBJECTIVE: Explore the use and efficiency of photographic remote sensing in low-intensity soil surveys. Develop the use of aerial photographic ocean and estuary surveys on the Maine Coast. Accumulate, as a result of ongoing research, material for a remote sensing atlas of Maine's herbaceous vegetation. Explore various aspects of disease problems in apples and blueberries using aerial photographic techniques.

APPROACH: All objectives are being explored using existing research land and personnel. All photography is low level and intended to expand the work already underway. Except for underwater detail, as in objective 2, the work is concentrated on the use of black and white and color infrared imagery.

PROGRESS:

SUPPORTED BY Maine State Government - Augusta

5.0027, LABORATORY MODELLING OF OCEANIC PHENOMENA
O.M. PHILLIPS, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (NSG 5161)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0028, LABORATORY STUDY OF RESONANCE FLUORESCENCE IN ATMOSPHERIC GASES
T.J. MCILRATH, Univ. of Maryland, Graduate School, *College Park, Maryland* 20740 (NAS 5-24130)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0029, FIELD-ALIGNED CURRENTS IN THE POLAR REGIONS
T.A. POTEMRA, Johns Hopkins University, Applied Physics Laboratory, *Laurel, Maryland* 20810 (ATM76-81211)

This grant will support a program of acquisition, analysis and interpretation of the data obtained from the Navy/Applied Physics Laboratory satellite TRIAD. The TRIAD magnetometer experiment remains the only means of studying field-aligned currents at relatively low satellite altitudes on a continuous basis. The program would establish an automatic data acquisition ground station at Resolute, Canada, and continue the operation of the station at McMurdo, Antarctica. Selected passes of TRIAD magnetometer data from College, Alaska, will be collected for correlation with the radars located at Chatanika and Homer, Alaska, and from Fort Churchill, Canada, and Prince Albert, Canada, for correlation with various ground-based magnetometer chains and radar observations scheduled for the IMS (International Magnetospheric Study). The primary objectives of this study are: (1) To determine the distributions and characteristics of magnetic disturbances (and the related field-aligned currents) in the polar cap and cusp region. (2) To correlate the characteristic field-aligned currents in the polar cap, cusp and auroral region with ionospheric current systems determined from the extensive ground-based observations scheduled for the IMS. (3) To determine the relationship of field- aligned currents with ionospheric scintillations observed to the VHF transmissions from TRIAD. (4) To continue the correlation of the TRIAD magnetometer data with measurements of low-energy electron fluxes from the Atmosphere Explorer C and D satellites.

SUPPORTED BY U.S. Natl. Science Foundation

5.0030, AVIATION AUTOMATIC WEATHER OBSERVING SYSTEMS (AV-AWOS)
J.A. CUNNINGHAM, U.S. Dept. of Commerce, Equipment Development Lab., *Silver Spring, Maryland* 20910 (RD5907)

TECHNICAL OBJECTIVE: The development of a procurement specification for the Aviation Automatic Weather Observing System (AV- AWOS).

APPROACH: 1. Execution of the AV-AWOS ceilometer procurement. 2. Execution of the AV-AWOS system upgrade. 3. Execution of the AV-AWOS field evaluation at Patrick Henry Field, Newport News, Virginia. 4. Completion of all AV-AWOS algorithms by Office of Technical Services (OTS), Test and Evaluation Division, Observation Techniques Branch. 5. Certification of AV-AWOS by NWS.

PROGRESS (July 1975 to October 1976): Design and assembly of a developmental aviation-automatic weather observing system (AV-AWOS) model to automatically collect and disseminate required airport meteorological information was finalized. The developmental AV-AWOS model was installed, tested and demonstrated feasible at Sterling, Virginia. Improvements in the cloud and visibility algorithms were accomplished.

A contract will soon be awarded for three laser ceilometers. The RFP package for the AV-AWOS system upgrade/integration effort should be issued for procurement soon.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

5.0031, ABSOLUTE TRANSITION PROBABILITIES IN ULTRAVIOLET SPECTRA OF INTERSTELLAR MOLECULES
W.H. PARKINSON, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (NSG 7304)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0032, MAGNETIC PARALLELS LUNAR, METEORITIC, AND TERRESTRIAL ROCKS
A. BRECHER, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (NSG 9057)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0033, THEORETICAL AND NUMERICAL STUDY OF CLIMATE AND CLIMATE CHANGE
J.G. CHARNEY, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (NSG 5166)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0034, STUDIES OF STRESS HISTORY OF TERRESTRIAL LITHOSPHERES
S.C. SOLOMON, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (NSG 7297)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0035, AIRBORNE MAPPING OF THE SPECTRAL CHARACTERISTICS OF WATER
P. HASELL, Environmental Res. Inst. Mich., *Ann Arbor, Michigan* 48107 (7-713; 04-5-158-58)

A narrow spectral band (20nm), high sensitivity, multiband (9) special detector assembly was fabricated and used in the ERIM airborne M7 multispectral scanner to map water characteristics at visible wavelengths in test sites in Lake Michigan and off the coast of southern California. Selected portions of the west coast data were computer processed to retrieve absolute radiometric calibration for comparison with surface measurements. These data were transmitted to NESS and SIO, Visibility Laboratory, for analyses. Initial results which compared derived aperture radiances from surface measurments to the M7 measurements are in reasonable agreement (approximately 20% to 10% variation).

All primary objectives were satisfactorily completed under this grant.

A separate SPOC add-on investigation evaluated the merit of shifting LANDSAT-C, band 4, for improved mapping of water characteristics.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0036, LAND-USE MAPPING IN DIGITAL FORMAT FROM AIR PHOTOS
C.E. OLSON, Univ. of Michigan, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0067794; MICY00040-F)

OBJECTIVE: Develop an interactive, digital, storage and retrieval system for land-cover data extracted from air photos. Complete land- cover mapping of Washtenaw Co., Mich., in this digital format.

APPROACH: A one-hectare grid based on the UTM coordinate system is used as the matrix for land-cover data. Also included is a four-level expansion of the classification system in USGS Circular 671, and demographic, transportation, and soil permeability data. The classification scheme includes 150 forest classes. All data inputs are based on human interpretation of existing air photos.

PROGRESS: The data base is now approximately 75 percent complete. Additional computer software is being developed as an extension to the CLOVER program developed for Project SNAFOR. Problems encountered by the change in UTM Grid Zone in western Washtenaw County have been overcome by mathematical extension of Grid Zone 17, westward into Grid Zone 16.

SUPPORTED BY Michigan State Government - Lansing

5.0037, STUDIES OF ODD NITROGEN IN THE MESOSPHERE AND LOWER THERMOSPHERE
D.W. RUSCH, Univ. of Michigan, Graduate School, *Ann Arbor, Michigan* 48104 (NSG 5171)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0038, THE PHYSICAL AND CHEMICAL PROPERTIES OF THE PREBIOTIC ATMOSPHERE
UNKNOWN, Univ. of Michigan, Graduate School, *Ann Arbor, Michigan* 48104 (NSG 7308)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0039, DYNAMICAL AND OBSERVATIONAL BEHAVIOR OF SEVERE LOCAL STORMS
Y. LIN, St. Louis University, School of Arts & Sciences, *St. Louis, Missouri* 63103 (ATM74-09448 A02)

What factors are responsible for determining the observed direction and speed of large rotating severe thunderstorms? This is the major thrust of the proposed research. A combination of mesoscale observations and numerically simulated air motions within the clouds will be used to achieve an understanding of the storm's propagation as the latter relates to the following factors: (1) vertical shear of the horizontal wind, (2) perturbation pressure forces arising from storm- environment interaction, (3) updraft-downdraft interactions in the lower six kilometers of the cloud, and (4) the boundary layer physics of mesoscale vortex. The simulated results of air motions within the supercell will be verified using Doppler wind and research aircraft observations from two field investigations.

SUPPORTED BY U.S. Natl. Science Foundation

5.0040, CHEMICAL STUDIES OF MATERIALS AND PROCESSES IN THE LUNAR REGOLITH AND OF LUNAR AND TERRESTRIAL IGNEOUS DIFFERENTIATION
L.A. HASKIN, Washington University, Graduate School, *St. Louis, Missouri* 63130 (NSG 9055)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0041, DATA ANALYSIS AND COMPUTER MAPPING
J.J. CRAIGHEAD, Univ. of Montana, State Coop. Wildlife Res. Unit, *Missoula, Montana* 59801 (NAS 5-23891)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0042, REMOTE SENSING APPLICATIONS FOR THE ANALYSIS AND MANAGEMENT OF RENEWABLE NATURAL RESOURCES
P.T. TUELLER, Univ. of Nevada System, Agric. Experiment Station, *Reno, Nevada* 89507 (0067967; NEV00614)

OBJECTIVE: Investigate remote sensing techniques for application to natural resources management including range, forestry, wildlife, watershed, outdoor recreation and crop agriculture. Test techniques for vegetation mapping, wetland inventory, range condition and trend, erosion evaluation, and economic value. Assess site biomass and production, land-use mapping and classification. Conduct resource inventories and serve as a repository for remote-sensing data.

APPROACH: Various scales (1:600 to 1:1,000,000) of color and color infrared film types along with actual ground data, densitometers, and field-averaging spectrographs will be used to identify phenomena relative to subjects being investigated. Accepted and experimental techniques and procedures will be used and evaluated. Computerized imagery from LANDSAT 1 and 11 will be evaluated. In all cases application will be emphasized.

PROGRESS: Photointerpretation keys which were developed last year have been refined. Preliminary evaluation indicated that they were effective in identifying plant communities. Refinement was based on detailed ground data collected this last summer and included photo characteristics associated with dominant and associated plant species present in each of the six study areas. Each site was photographed during the 1975 field season and studied in conjunction with previous photography. Preliminary evaluation of the field-averaging spectograph camera attachment has been made preparatory to its application in accessing site productivity. Spectral curves for various native plants have been examined and contrasts in spectral reflectance observed. Differences between clipped and unclipped, pre-study, grass plots have been observed but quantitative data extraction has been delayed pending further refinement on calibration, film exposure, and interpretative procedures. Permanent Hilaria jamesii plots have been established for use with the study.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0043, COMPILATION OF GLOBAL TECTONIC MAPS
K. BURKE, State University of New York, Graduate School, *Albany, New York* 12203 (NAS 5-24094)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0044, WAVE PROPAGATION STUDY
S.H. GROSS, Polytechnic Inst. of New York, School of Science & Engin., *Brooklyn, New York* 11201 (NAS 5-24086)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0045, PHASE STABILITY AND ELASTIC WAVE VELOCITY DETERMINATIONS FOR STOICHIOMETRIC FES
T. TAKAHASHI, City University of New York, School of Liberal Arts & Sci., *Flushing, New York* 11367 (NSG 7321)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0046, EARLY CLIMATE ON EARTH-REDUCED GAS MODELS AND EARLY CLIMATE ON MARS-REDUCED GAS AND OBLIQUITY MODELS
O.B. TOON, Cornell University, Graduate School, *Ithaca, New York* 14850 (NCA 2-175702)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0047, TO CONDUCT LABORATORY MEASUREMENTS IN HIGH-RESOLUTION SPECTROSCOPY OF ATMOSPHERIC MOLECULES
UNKNOWN, Duke University, Graduate School, *Durham, North Carolina* 27706 (L-50695A)
SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0048, NORTH DAKOTA RANGELAND INVENTORY
W.T. BARKER, North Dakota State University, Agric. Experiment Station, *Fargo, North Dakota* 58103 (0070963; ND01918)

OBJECTIVE: Map North Dakota rangelands and periodically update this information. Determine species composition, relative productivity, present condition and distribution of plant communities in the major rangeland types within North Dakota. Interpret successional trends in major North Dakota rangeland types. Provide rangeland data for the North Dakota Agricultural Experiment Station's North Dakota Resource Inventory, Information Management and Monitoring System (RIMS).

APPROACH: North Dakota rangelands will be mapped using available aerial photography and satellite imagery with field verification of vegetation type boundaries. Species composition, relative productivity, and present condition data will be obtained from selected study sites using points analysis and clipping techniques. The data will be prepared in tabular and map form to be inputted to the North Dakota Agricultural Experiment Station's North Dakota Resource Inventory, Information Management and Monitoring System (RIMS).

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0049, UTILIZATION OF SATELLITE DATA AND REGIONAL SCALE NUMERICAL MODELS IN SHORT-RANGE WEATHER FORECASTING
C. KREITZBERG, Drexel University, School of Hum. & Soc. Sci., *Philadelphia, Pennsylvania* 19104 (NSG 5162)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0050, ANALYSIS OF STRATOSPHERIC AND MESOSPHERIC DATA
L.C. HALE, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (NAS 6-2826)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0051, ENERGY CONSERVATION TASK TO IMPROVE CONSERVATION IN BALTIMORE CITY
W.T. SNYDER, Univ. of Tennessee, School of Engineering, *Knoxville, Tennessee* 37916 (NAS 5-23898)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0052, ORIGIN OF CHANNELS ON MARS
V.R. BAKER, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (NSG 7326)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0053, INVESTIGATIONS INTO AFFINE TRANSFORMATION ALGORITHMS FOR SIGNATURE EXTENSION
T.F. MCCABE, Pan Amer. University, Graduate School, *Edinburg, Texas* 78539 (NSG 9053)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0054, COLOR TONE VARIATION OF LOBLOLLY PINE CROWNS ON THE AERIAL PHOTOGRAPH
R.D. BAKER, Stephen F. Austin State Univ., School of Forestry, *Nacogdoches, Texas* 75961 (0067115; TEXY-74-006)

OBJECTIVE: Test the effect that four variables have on color tone of single species tree crowns within the aerial photograph. The independent variables to be investigated are radial distance from the principal point, radial displacement of the tree, radian location on the aerial photograph, ground elevation difference between the principal point and the base of the measured tree.

APPROACH: 181 loblolly pine trees (totaling 403 multiple images of these trees on side-lapping and overlapping photographs) have been located in Newton County, Texas (the site of a proposed atomic power generating plant). The color tone of each of these images will be determined using Munsell color chips. A multiple-regression analysis of the four variables listed above with tree color tone will be performed. A final multiple-regression equation will be tested on different tree crowns in the general area of the test trees.

SUPPORTED BY Texas State Government - Austin

5.0055, THE APPLICATION OF REMOTE-SENSING SURVEY TECHNIQUES IN ROAD ENGINEERING
T.E. BEAUMONT, Ministry of Transport, Transport & Road Research Lab., *Crowthorne, England, United Kingdom* (087634 (HRB NO.))

This project involves the following: (1) evaluation of the application of remote-sensing survey techniques to the planning and site-investigation stages of road construction. Emphasis is on the use of multispectral photographs taken from light aircraft for identification of unstable ground and other problems in mountainous terrain. (2) Evaluation of satellite imagery as a basis for engineering soil mapping, route location and transport planning in regional development. (3) Investigation of advanced image interpretation techniques for analysis of remote-sensing imagery and satellite computer-compatible tapes. Work will include studies of photographs and imagery covering areas in Nepal, Africa, South America and South East Asia. /IRRD/IRF/

ADDENDA: Document provided to S.S.I.E. by the H.R.I.S.

SUPPORTED BY United Kingdom - Min. of Overseas Devel.

5.0056, COE LANDSAT STUDIES
L.P. MURPHY, U.S. Army, Engineer Topographic Labs., *Fort Belvoir, Virginia* 22060 (31545)

OBJECTIVES: To determine the hardware/software systems requirements and tradeoffs to enable interface and utilization of advanced NASA LANDSAT systems for COE remote sensing applications.

APPROACH: Engineer requirements/applications data will be collected through interaction with COE Headquarters, the Engineer Committee on Applications, and Region Offices. During the first year, a contracted study will be performed to determine COE communications link tradeoffs and to identify potential hardware/software systems. Subsequently, a contract will be awarded to assess hardware/software and costs to classify data from LANDSAT output for COE applications. During the foregoing contractual efforts, classification software will be added to the ETL interactive Digital Image Processing Facility; conceptual models and extraction algorithms will be developed with a minimum set of software for COE applications; a period of digital data extraction techniques development and testing will follow. The results of ETL in- house modeling, analysis, and classification testing will be used to add to and/or evaluate the results of the contracted 'COE LANDSAT Studies.' An upper-management-level briefing will then be conducted to determine if work should progress to systems design, fabrication, and production implementation of a hardware/software system for delivery to the appropriate COE central processing site.

SUPPORTED BY U.S. Dept. of Defense - Army

5.0057, DATA REDUCTION ANALYSIS FOR ATMOSPHERIC TRACE GAS CONSTITUENTS DERIVED FROM REMOTE SENSORS (ABBREV)
E.C. KINDLE, Old Dominion University, School of Sciences & Health, *Norfolk, Virginia* 23508 (NSG 1395)

Data reduction analysis and application technique development for atmospheric trace gas constituents derived from remote sensors on satellite or airborne platforms.

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0058, EVALUATION OF ATMOSPHERIC TRACE-CONSTITUENT SENSORS OPERATING FROM REMOTE SPACE AND AIRBORNE PLATFORMS
E.C. KINDLE, Old Dominion University, School of Sciences & Health, *Norfolk, Virginia* 23508 (NSG 1394)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0059, REMOTE SENSING APPLICATIONS TO LAND RESOURCE INVENTORY
B.E. FRAZIER, Washington State University, School of Agriculture, *Pullman, Washington* 99163 (0070070; WNP00323)

OBJECTIVE: Determine suitability of LANDSAT-based information for land resource inventories. Develop subclasses to the Anderson land-use classification that have utility as a data base for local planners. Evaluate other remote sensing systems and techniques for potential application to land resource studies as they become available.

APPROACH: An investigation of LANDSAT-based information products for rural land-use applications will be conducted using Whatcom Co. data. Functional subclasses of the Anderson system will be devised. Photointerpretation and satellite imagery interpretation techniques will be developed to isolate required categories. Evaluate new systems as they become available for public use, i.e., remote sensing instruments, e.g., thermal energy detectors developed for military use.

SUPPORTED BY Washington State Government - Olympia

5.0060, CRYSTAL-LIQUID DISTRIBUTION COEFFICIENTS FOR SELECTED ELEMENTS
I.S. MCCALLUM, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (NSG 7313)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, GRAVITY BODY MASS AND COMPOSITION AND METABOLIC RATE
UNKNOWN, Univ. of California, Graduate School, *Berkeley, California* 94720 (NSG 7336)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0002, HUMAN PERFORMANCE UNDER SELECTED ENVIRONMENTAL STRESSES (ABBREV)
E.M. BERNAUER, Univ. of California, School of Letters & Science, *Davis, California* 95616 (NCA 2-180703)

Human performance under selected environmental stresses; effects of heat acclimation and physical training on the body fluids and temperature responses during heat stress.

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0003, STUDY OF BIOLOGICAL AND ECOLOGICAL EFFECTS OF ENERGY TRANSMISSION BY MICROWAVES ON INSECT BEHAVIOR
N.E. GARY, Univ. of California, School of Agric. & Envir. Sci., *Davis, California* 95616 (NAS 2-9539)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0004, A UNIFIED SYSTEM FOR THE BIOLOGICAL EXPLORATION OF MARS
R.C. BALLARD, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NSG 2213)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0005, FLUID AND ELECTROLYTE HOMEOSTASIS DURING SPACEFLIGHT, GROUND-BASED PREPARATIVE STUDIES IN A PRIMATE
M.C. MOOREEDE, Harvard University, Graduate School, *Cambridge, Massachusetts* 02138 (NSG 9054)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0006, EVALUATIONS OF POSTURAL MECHANISMS UNDER DYNAMIC CONDITIONS
D. ANDERSON, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (NAS 9-15244)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0007, EFFECTS OF WATER HYACINTH SUBSTANCES UPON THE GROWTH OF YEAST OF THE GENUS CANDIDA
P. STOCKS, Univ. of Southern Mississippi, School of Science & Technology, *Hattiesburg, Mississippi* 39401 (NAS13-54)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0008, ENVIRONMENTAL AND GENETIC EFFECTS ON GRAVITY RECEPTORS, A MORPHOLOGICAL, PHYSIOLOGICAL AND BEHAVIORAL STUDY
D.J. LIM, Ohio State University, School of Medicine, *Columbus, Ohio* 43212 (NSG 2220)

SUPPORTED BY U.S. Natl Aero. & Space Adm.

6.0009, FLUID MECHANICS PROBLEMS IN ARTERIAL DISEASE
R.M. NEREM, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (ENG71-02286 A03)

This action provides for an additional year of support for NSF Grant ENG71-02286.

The nature of arterial blood flow will be studied through a combined experimental and theoretical effort. Particular emphasis will be placed on the effects of vessel branching.

The experimental studies will involve the measurement of velocity profiles and wall shear stress using a constant temperature hot-film anemometer. Data will be obtained both in vivo using horses and dogs as well as in a pulsatile flow bench top system. The theoretical studies will involve numerical calculations of three-dimensional, unsteady flow in a bifurcating tube.

Studies of blood flow turbulence also will be considered. Included will be in vivo hot film measurements and the spectral analysis of data obtained. However, the primary emphasis will shift to the numerical calculation of pulsatile flow in a cylindrical tube including the generation and decay of turbulence during a flow cycle.

An additional problem area to be investigated as a part of this effort is unsteady two-dimensional and axisymmetric laminar flow through a series of constrictions.

Finally, the previous mass transport studies will be extended to include the investigation of blood-arterial wall transport for both cholesterol and fibrinogen.

SUPPORTED BY U.S. Natl. Science Foundation

6.0010, NASA CONFERENCE ON MEAL SYSTEM FOR THE ELDERLY
UNKNOWN, Univ. of Texas, Graduate School, *Austin, Texas* 78712 (NAS 9-15297)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0011, STUDY OF BIOLOGICAL AND ECOLOGICAL EFFECTS OF ENERGY TRANSMISSION BY MICROWAVES
A.W. GUY, Univ. of Washington, School of Medicine, *Seattle, Washington* 98122 (NAS 2-9536).

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, COMPUTER GRAPHICS - INTEGRATION OF TWENTY YEARS' EXPERIENCE
R.J. ABBOTT, Calif. State Univ. & Colleges, School of Business Adm. & Econ, *Northridge, California* 91324 (NSG 4011)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

7.0002, NUMERICAL SOLUTION OF STIFF DIFFERENTIAL EQUATIONS
G.H. GOLUB, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (NCA 2-745712)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

7.0003, STUDY OF SEVERAL PROBLEMS RELEVANT TO THE DESIGN AND PERFORMANCE OF DISTRIBUTED COMPUTING NETWORKS
A.K. AGRAWALA, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (NAS 5-24092)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

7.0004, MATHEMATICAL PHYSICS
B.M. SIMON, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (MCS75-11864 A02)

This work continues that done under GP-39048, Amendment Number 1.

Bargmann, Frohlich, Rosen, and Simon will work on a variety of problems in mathematical physics, including work in the following areas: (1) quantum field theory, especially the constructive quantum field theory of the P(phi)2, Y2 and (phi 4)3 field theories; (2) the theory of Schrodinger operators including n-body scattering theory and the approximation of atomic physics (Hartree-Fock, Thomas-Fermi theory); (3) problems in statistical mechanics including, but not limited to, the connections with quantum field theory; and (4) problems in the approach to group representation theory which exploits Hilbert spaces of analytic functions.

SUPPORTED BY U.S. Natl. Science Foundation

7.0005, A HIGH ORDER ACCURATE FINITE ELEMENT ALGORITHM FOR HIGH REYNOLDS NUMBER FLOW PREDICTION
A.J. BAKER, Univ. of Tennessee, Graduate School, *Knoxville, Tennessee* 37916 (NSG 1391)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

7.0006, RESEARCH OF AUTONOMOUS SATELLITE NAVIGATIONAL METHODS USING GLOBAL POSITIONING SATELLITE SYSTEM
B.D. TAPLEY, Univ. of Texas, School of Engineering, *Austin, Texas* 78712 (NSG 5154)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

7.0007, INTERACTIVE SOFTWARE INVOCATION SYSTEM
W.J. BERMAN, Univ. of Virginia, School of Engin. & Appl. Sci., *Charlottesville, Virginia* 22903 (NAS 1-14862)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

7.0008, THE HARDWARE AND SOFTWARE ASPECTS OF REAL-TIME FLIGHT SIMULATION
E.A. PARRISH, Univ. of Virginia, School of Engin. & Appl. Sci., *Charlottesville, Virginia* 22903 (NSG 1403)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EXPERIMENTAL RESEARCH ON THE THERMODYNAMIC PROPERTIES OF SULFURIC ACID
R.A. MORRISON, Talladega College, Undergraduate School, *Talladega, Alabama* 35160 (NSG 2217)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0002, LOW-DUTY-CYCLE MOLECULAR-BEAM MASS-SPECTROMETER SAMPLING
E.L. KNUTH, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (NCA 2-390702)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0003, GYRO TEST OF GENERAL RELATIVITY IN A SATELLITE
W.M. FAIRBANKS, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (NAS 8-32355)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0004, RADIATION DOSIMETRY EXPERIMENT ON U.S.S.R./U.S. KOSMOS 77 FLIGHT
E.V. BENTON, Univ. of San Francisco, School of Science, *San Francisco, California* 94117 (NAS 2-9504)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0005, COSMIC-RAY NEUTRON DOSIMETRY
A.B. TUCKER, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NCA 2-675708)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0006, DEVELOPMENT OF TWO-DIMENSIONAL ENERGY CONSERVATION EQUATIONS IN A MATHEMATICAL MODEL OF THE UPPER IONOSPHERE OF VENUS
P.T. MCCORMICK, Univ. of Santa Clara, School of Science, *Santa Clara, California* 95053 (NCA 2-685707)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0007, LABORATORY SIMULATION OF IRRADIATION-INDUCED DIELECTRIC BREAKDOWN IN SPACECRAFT CHARGING
E.J. YADLOWSKY, Colorado State University, School of Engineering, *Fort Collins, Colorado* 80521 (NSG 3145)
SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0008, ELECTRONIC ENERGY LEVELS IN PARAMAGNETIC CRYSTALS
J.W. STOUT, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (DMR77-07143)

Magnetic, optical and thermal properties of paramagnetic crystals, in particular the salts of metallic ions with incompletely filled shells of 3d electrons, are being investigated. The research includes measurements of magnetic susceptibility, optical absorption in the visible and infrared, and low-temperature heat capacity of crystals containing magnetic ions, as pure salts and as solid solutions in diamagnetic hosts.

This is a continuation of research supported under DMR-73-02487.

SUPPORTED BY U.S. Natl. Science Foundation

8.0009, A CONCEPTUAL DESIGN FOR SPACELAB POOL BOILING EXPERIMENTS
J.H. LIENHARD, Univ. of Kentucky, School of Engineering, *Lexington, Kentucky* 40506 (NAS 3-20397)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0010, RESEARCH IN THEORETICAL PHYSICS
G. DOMOKOS, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (EY-76-S-02-3285)

Investigation of dynamical generation of internal symmetries, algebraic realization of color selection rules in quark models. Color selection rules may be obtained by constructing algebra of local observables which is necessarily not associative. Propose construction of such algebras within framework of geometrical theories. Some of the broken internal symmetries appear as a consequence of the geometry of vacuum solutions.

RESULTS: Simple models exhibiting generation of broken internal symmetries through geometry of vacuum solutions have been found. Algebras were constructed which obey color selection rules but without internal symmetries.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0011, SURFACE EFFECTS IN THE PLASTICITY OF CRYSTALLINE SOLIDS
R.M. LATANISION, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DMR76-06854)

This research will be a surface science approach to studying how surface effects can influence crystal plasticity in semiconductors and insulators. The major aim will be to study the effect of changes in the space charge distribution on dislocation mobility about hardness impressions in cadmium sulfide single-crystal surfaces exposed to subbandgap illumination. The exposure will achieve the flat-band condition as determined by surface photovoltage spectroscopy. The dislocation mobility will be systematically measured as a function of the charge distribution away from the flat-band condition. Surface photovoltage will be measured as the change in steady-state contact potential difference with respect to a vibrating gold-boss reference electrode, by means of an off-null measurement technique. This research is expected to shed light on the mechanisms of photomechanical effects.

SUPPORTED BY U.S. Natl. Science Foundation

8.0012, EXPERIMENTAL STUDIES OF PHASE TRANSITIONS
P. HELLER, Brandeis University, School of Arts & Sciences, *Waltham, Massachusetts* 02154 (DMR75-03610 A02)

The research program supported by NSF Grant GM-36612 will be continued. The proposed research program includes: nuclear magnetic resonance and neutron scattering studies of static behavior in antiferromagnets in applied magnetic fields; nuclear magnetic resonances, neuron scattering and computer simulation studies of dynamical behavior in spin systems; light scattering studies of solids and gases. These experiments are expected to contribute to our understanding of static and dynamic behavior near phase transitions.

SUPPORTED BY U.S. Natl. Science Foundation

8.0013, THEORETICAL STUDIES IN SOLID-STATE PHYSICS
T.A. KAPLAN, Michigan State University, School of Natural Sciences, *East Lansing, Michigan* 48824 (DMR76-16597)

This project supports a variety of topics in theoretical solid-state physics. It includes studies in the following areas: phase transitions involving mixed configurations in samarium compounds; excitations in rare-earth semiconductors involving localized holes; structural, magnetic, and optical properties of alkali superoxides; thermal single determinant approximation; study of one-electron states for strongly correlated narrow-band electrons; band theory and exchange interactions in semi-conductors and insulators.

Reference: DMR72-03149 A02.

SUPPORTED BY U.S. Natl. Science Foundation

8.0014, TRIAXIAL DROP SHAPES - ROTATING AND CHARGED LIQUID DROPS
L.E. SCRIVEN, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (NSG 7296)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0015, ACOUSTIC MAGNETIC RESONANCE STUDIES OF SOLIDS
D.I. BOLEF, Washington University, School of Engin. & Appl. Sci., *St. Louis, Missouri* 63130 (DMR74-00360 A02)

Experimental studies in acoustic magnetic resonance previously supported by NSF grant DMR74-00360 will be continued. This work will be of a collaborative nature, involving both experimental and theoretical attacks on the problem of discovering and understanding the nature of the coupling of ultrasound to nuclear and electron spins in solids and applying this understanding to the characterization of materials. Specific topics which will be investigated include: nuclear acoustic resonance studies of transition metal hydride systems; studies of ferromagnetic metals by acoustic absorption and dispersion, and non- resonant (delta m equals 0) interactions in strongly coupled spin-phonon systems.

SUPPORTED BY U.S. Natl. Science Foundation

8.0016, DEVELOPMENT OF ULTRASONIC TECHNIQUES FOR NON-DESTRUCTIVE EVALUATION BASED ON FOURIER ANALYSIS OF SIGNALS FROM STRUCTURES (ABBREV)
J.G. MILLER, Washington University, School of Arts & Sciences, *St. Louis, Missouri* 63130 (NSG 1392)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0017, EXPERIMENTAL DETERMINATION OF THE TEMPERATURE DEPENDENCE OF METALLIC WORK FUNCTIONS AT LOW TEMPERATURES
P.B. PIPES, Dartmouth College, School of Arts & Sciences, *Hanover, New Hampshire* 03755 (EY-76-S-02-2314)

The effect of the superconducting transition on the temperature dependence of the contact potential in niobium will be studied as a function of magnetic field and surface preparation to determine the relative importance of bulk and surface effects. A search will be made for a similar effect in composite samples of a lead layer on a copper or niobium substrate. Also experiments on the thermomagnetic flux generated by temperature gradients in superconducting rings containing weak links will be initiated.

RESULTS: Noise thermometer developed; thermomagnetic effect in superconducting loop predicted; temperature dependence of contact potentials in niobium and aluminum measured (super-conducting transition seen in niobium); theoretical model

for effects of adsorbed gas developed and compared with data for 4He on niobium; temperature dependence of contact potentials in copper and tantalum measured.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0018, USE OF MOSSBAUER EFFECT IN SOLID-STATE AND NUCLEAR PHYSICS
N. KOLLER, Rutgers the State University, School of Arts & Sciences, *New Brunswick, New Jersey* 08903 (DMR76-02053 A01)

The experimental investigations of solids using the Mossbauer technique which were previously supported by NSF grant DMR-7302387 will be continued. The spin polarization of individual s-electrons of magnetic and non-magnetic elements in magnetic materials will be studied in order to obtain a detailed quantitative description of hyperfine interactions in such materials. The investigations will be carried out by a new technique which combines Mossbauer spectroscopy with Conversion Electron Spectroscopy. Also, the lattice dynamics of single crystal materials, granular materials and amorphous materials will be investigated by conventional Mossbauer spectroscopy.

SUPPORTED BY U.S. Natl. Science Foundation

8.0019, PROBLEMS ON THE THEORY OF CRYSTAL GROWTH AND ON THE SPIN PEIERLS TRANSITION
S. CHUI, State University of New York, School of Arts & Sciences, *Albany, New York* 12222 (DMR76-11338)

Two areas of theoretical research will be investigated: (1) the theory of crystal growth, using the concept of the roughening phase transition, and (2) the spin-Peierls transition which occurs in certain types of anti-ferromagnets.

SUPPORTED BY U.S. Natl. Science Foundation

8.0020, JOINT US-USSR COLLABORATION IN SEMICONDUCTOR PHYSICS (ABBREV)
J.W. CORBETT, State University of New York, School of Arts & Sciences, *Albany, New York* 12222 (INT76-10315)

This grant is to support the establishment of a two-year collaboration between the Institute for the Study of Defects in Solids and the Institute for Semiconductor Physics in Novosibirsk, USSR. This collaboration will take the form of exchanges of senior scientists, joint projects and coordinated research programs in the area of semiconductors. US scientists are to be exposed to the current Soviet state of research in this field at one of the most advanced research centers in the USSR.

SUPPORTED BY U.S. Natl. Science Foundation

8.0021, SUPERCONDUCTIVITY IN SPUTTER-STABILIZED A 15 SYSTEMS
F.J. CADIEU, City University of New York, School of Liberal Arts & Sci., *Flushing, New York* 11367 (DMR74-18138 A01)

This research will be the completion of work started under grant DMR74-18138. Superconductivity will be studied in various A-15 compounds which are difficult to stabilize in stoichiometric form such as Nb3Ge. Experiments are designed to provide information relating to film composition, the possibility of epitaxial growth and the stabilization by inclusions of nitrogen and oxygen.

SUPPORTED BY U.S. Natl. Science Foundation

8.0022, HIGH-ENERGY PHYSICS
L.M. LEDERMAN, Columbia University, School of Arts & Sciences, *New York, New York* 10027 (PHY76-84396)

The research program at Columbia University's Nevis Laboratories involves experiments at several high-energy physics accelerator laboratories. Experiments in progress include: 1. Lepton production at Fermilab to study massive mu-pairs and e-pairs. 2. Photoproduction at Fermilab and multi-lepton and multihadron final states. 3. Proton- proton inelastic scattering at Fermilab. 4. Neutrino interactions involving neutral current leptonic and semi-leptonic processes at Brookhaven National Laboratory. 5. Direct lepton production and hadron production with high transverse momentum at the CERN Intersecting Storage Rings. 6. Neutrino interactions in bubble chambers filled with heavy liquid, exposed to wide and narrow momentum band beams at Brookhaven and Fermilab. 7. Development of instrumentation for elementary particle physics, drift chambers, on-line pattern recognition electronic logic systems and new experimental techniques for particle detection and event selection.

This work is a continuation of that currently supported by Foundation grant number PHY75-06955A02.

SUPPORTED BY U.S. Natl. Science Foundation

8.0023, ITINERANT ELECTRON ANTIFERROMAGNETISM AND LOCALIZED MAGNETIC MOMENTS
S. ARAJS, Clarkson College of Technology, Graduate School, *Potsdam, New York* 13676 (DMR76-09198)

A very basic problem in the field of magnetism - the behavior of localized magnetic moments in an itinerant electron antiferromagnetic matrix - will be studied. Currently, there is considerable research activity in the related areas of conventional spin glasses and micromagnetism. The scope and the understanding of this field of magnetism will be extended by carrying out theoretical calculations and high-accuracy experimental investigations (magnetic susceptibility and electrical resistivity) on chromium alloys containing localized moment solutes such as iron, cobalt, and manganese. Theoretical and experimental studies of the temperature dependence of the magnetic susceptibility of pure chromium and binary chromium alloys without localized moments will be carried out. This research will address the problem of the static magnetic properties of itinerant electron antiferromagnets and open a new area of research activity dealing with the behavior of localized moments in such systems.

SUPPORTED BY U.S. Natl. Science Foundation

8.0024, PLASMA STABILITY THEORY
A. SIMON, Univ. of Rochester, School of Engin. & Appl. Sci., *Rochester, New York* 14627 (E(11-1)-3497)

Nonlinear threshold saturation limits will be calculated for the dissipative trapped-electron and the drift cyclotron loss cone instabilities. Turbulent transport estimates will be made for the trapped electron instability in Tokamak geometry, in addition to inclusion of collisional and boundary layer effects on the linear properties of this instability. Multi-mode nonlinear survival competition will be studied, and comparison made with Dupree theory limits.

RESULTS: A general theory of threshold nonlinear saturation, including collisionless plasma. Application of this method to 8 plasma instabilities and comparison with experiments. Detailed linear treatment of finite-beta, resonant-electron and collisional effects on the drift and trapped-electron instabilities in sheared magnetic fields. A total of 18 journal articles and 7 Ph.D. theses.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - M.F.E.D.

8.0025, NUCLEAR STRUCTURE RESEARCH
L.W. SEAGONDOLLAR, Univ. of North Carolina, School of Math. & Phys. Scis., *Raleigh, North Carolina* 27607 (EY-76-S-05-3624)

The Triangle Universities Nuclear Laboratory is jointly staffed by physicists from Duke University, the University of North Carolina at Chapel Hill, and North Carolina State University. The proposed work is a continuation of the work of the NCSU group. Work will be done in collaboration with physicists from the two other institutions as well as with others from NCSU. Programs proposed are a) determination of neutron cross sections that are needed in proposed controlled thermo- nuclear reactors for power production using the TUNL time-of-flight system, b) the measurement of some charged particle cross sections needed in this same area, c) high resolution studies of the fine structure of analog states, d) studies of giant-resonance phenomena via radiative capture reactions using polarized proton beams, e) gamma-ray spectroscopy in the low-medium mass region, and f) investigation of certain nuclear reactions caused by heavy-ion bombard-

ment and measured by the stacked foil technique supplemented by supporting measurements of the recoil ranges of the residual nuclei as well as their angular distribution. While instrumental and technique development goes on almost continuously in all the above areas, major development will occur in the coming year in area a). T-o-F distance available will be increased from 4-meter maximum to 6-meter maximum, a second shielded detector will be built and a tritium target installed.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0026, SORPTION OF CESIUM BY GRAPHITES AT HIGH TEMPERATURES
L.R. ZUMWALT, Univ. of North Carolina, School of Engineering, *Raleigh, North Carolina* 27607 (EY-76-S-05-4682)

The research deals with the sorption behavior of volatile fission product metals in nuclear grade graphites. It is relevant to a need for data and models on both mixed and single species fission product sorption behavior for use in making design and safety calculations for graphite moderated nuclear reactors. In particular, we propose to use the pseudoisopiestic method to determine the equilibrium vapor pressures of cesium as a function of its concentration and temperature for various mixtures of cesium, strontium and barium (tagged with 137Cs, 85Sr and 133Ba, respectively) sorbed by a typical nuclear grade graphite, the near-isotropic H-451.

The continuing research effort will be directed towards obtaining cesium sorption isotherms on barium-impregnated H-451 graphite at a series of concentrations (0 to approximately 7 micromoles Ba/gm C) at a sample temperature of 1000 degrees C and at cesium equilibrium vapor pressures ranging from approximately 10 to the minus 9th power atmospheres to 10 to the minus 4th power atmospheres. This effort will be similar to that previously conducted on strontium-impregnated H-451 graphite. These may be followed by similar experiments using barium and barium-strontium co-impregnated graphite samples, depending upon time and equipment availability. The experimental information obtained will be analyzed with respect to existing mixed sorption models by which the vapor pressures of cesium for mixtures of sorbed fission products may be predicted from single-component sorption data. These theoretical models will be evaluated and revised as necessary in light of the new experimental data to enhance their accuracy in estimating fission product release from nuclear graphites.

The kinetic (approach-to-equilibrium) data, which we here have obtained, will be analyzed by the coupled-diffusion model and other theories to further knowledge regarding the diffusion-sorption behavior of cesium in graphite. Also, barium concentration-dependent diffusion studies will be conducted on H-451 graphite utilizing 133Ba in barium- impregnated graphite samples.

Preliminary to mixed-sorption studies, the sorption of cesium alone by H-451 graphite at high temperatures was determined. It was found that very long times are required to reach equilibrium. (Text abridged)

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0027, THEORETICAL STUDIES IN NUCLEAR AND PARTICLE SCATTERING
K.L. KOWALSKI, Case Western Reserve Univ., School of Science, *Cleveland, Ohio* 44106 (PHY74-02239 A03)

Research initiated under NSF grant MPS74-02239 AO1 will be continued. Theoretical investigation of several areas of nuclear and particle scattering will include:

1. Multiparticle Scattering - Formal and calculational investigation of the dynamics of the scattering of several strongly interacting particles (primarily nucleons and pions) with special attention to three-particle scattering problems.

2. Studies in Medium-Energy Theory - Study of several aspects of scattering theory (including nucleon-nucleus scattering, multiple- scattering theories, and theories of the optical potential), pion- nucleon and pion-nucleus scattering, and the nucleon-nucleon problem at medium energies.

3. Development of New Methods in the Theory of Nuclear Reactions - Formal and calculational investigation having the goal of developing theoretical tools for dealing with the complex many-body aspects of nuclear reactions including elastic scattering, transfer reactions, and radioactive decay.

SUPPORTED BY U.S. Natl. Science Foundation

8.0028, INTERNATIONAL CONFERENCE ON HIGH PRESSURE AND LOW TEMPERATURE PHYSICS
C.W. CHU, Cleveland State University, School of Arts & Sciences, *Cleveland, Ohio* 44115 (NSG 3144)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0029, NUCLEAR PUMPED LASERS
W.E. WELLS, Miami University, Graduate School, *Oxford, Ohio* 45056 (NSG 1396)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0030, TEMPERATURE DEPENDENCE OF SILICON PRESSURE SENSORS
S.K. KAHNG, Univ. of Oklahoma, School of Engineering, *Norman, Oklahoma* 73069 (NSG 1404)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0031, A STUDY OF CONFINEMENT AND HEAT TRANSFER PROPERTIES OF LIQUID CRYOGENS
R.J. DONNELLY, Univ. of Oregon, School of Liberal Arts, *Eugene, Oregon* 97401 (NSG 2208)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0032, USE OF MODULATED BLACKBODIES IN A LONG-WAVELENGTH INFRARED DETECTOR TEST SYSTEM
R.J. DONNELLY, Univ. of Oregon, School of Liberal Arts, *Eugene, Oregon* 97401 (NCA 2-587702)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0033, VARIABILITY IN BE STARS
I. HOLT, Univ. of Oregon, Graduate School, *Eugene, Oregon* 97403 (NCA 2-587701)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0034, ELECTRON SPECTROSCOPY OF SOLID SURFACES
E.W. PLUMMER, Univ. of Pennsylvania, School of Arts & Sciences, *Philadelphia, Pennsylvania* 19104 (DMR75-09491 A01)

Major emphasis of this program, previously supported by NSF grant DMR75-09491, will be on the elucidation of intrinsic surface states and surface resonances on clean metal surfaces. The experimental program will utilize field and angular resolved photoemission spectroscopies and will be closely coupled with theoretical calculations. The experiments will be concentrated on surface resonances on 100 faces of W, Mo and Cr and on 111 faces of Cu, Au and Ag.

SUPPORTED BY U.S. Natl. Science Foundation

8.0035, LUNAR SAMPLE ANALYSIS
UNKNOWN, Univ. of Pittsburgh, Graduate School, *Pittsburgh, Pennsylvania* 15213 (NSG 9056)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0036, NUCLEAR STRUCTURE STUDIES USING PHOTONS
F.R. METZGER, Franklin Inst. of State of Pa., *Swarthmore, Pennsylvania* 19081 (PHY76-84097)

The resonant scattering of gamma-rays by bound states of nuclei will be studied, using electron bremsstrahlung as the photon source. The nuclear properties derived from these experiments will be used to test nuclear models over the entire range of stable nuclei. Of particular interest for the immediate future are studies of the concentration of electric dipole strength in vibrational nuclei, the distribution of E1 and M1 strength in deformed nuclei, studies of radiative width in the A equals 90 region, and accurate determinations of the strengths of corresponding transitions in mirror nuclei.

In contrast to other techniques for obtaining such strengths, e.g., inelastic particle scattering, Coulomb excitation, or the Doppler shift attenuation method, the methods used here are independent of model assumptions.

This work is a continuation of that currently supported by Foundation grant PHY71-03444 A04.

SUPPORTED BY U.S. Natl. Science Foundation

8.0037, SPECTROSCOPIC STUDIES OF SELECTED RADIATIVE TRANSITIONS IN ALKALI-RARE GAS EXCIMERS AND ALKALI DIMERS
J.B. TELLINGHUISEN, Vanderbilt University, School of Arts & Sciences, *Nashville, Tennessee* 37232 (NSG 1408)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0038, SURFACE STUDIES IN SOLIDS
V. CELLI, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (DMR76-17375)

Research previously supported under grant DMR72-03091 will be continued and extended. The general thrust of the research is in the development of the theory of scattering from a rough or periodic surface and of the bound and resonant states on such a surface. The theory has applications to a wide variety of surface phenomena, including the scattering of atoms and molecules, the scattering and diffraction of electromagnetic radiation and the electronic structure of surface kinks and steps. Particular emphasis will be on: (a) the application of the extinction theorems of optics to the calculation of optical and electronic properties, with application to semiconductor surfaces, and (b) the use of semiclassical path-integral methods in the theory of surface scattering into resonant surface states and in a multichannel theory of reactive scattering of atoms and molecules.

SUPPORTED BY U.S. Natl. Science Foundation

8.0039, ELECTRONIC PROPERTIES OF METALS, ALLOYS, AND MOLECULES
R.V. COLEMAN, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (EY-76-S-05-3105)

Research on this project is direct toward the measurement and understanding of the electronic structure of layer materials, 3d ferromagnetic metals, and dilute metallic alloys. Research is also underway on applications of inelastic electron tunneling spectroscopy to problems on orientation of surface adsorbed molecules, surface-molecular interactions, electron-phonon coupling in molecules, and uv radiation damage to molecules. Research techniques include measurement of transport properties in magnetic fields up to 230 kG, magnetic susceptibilities, and Raman scattering on single crystals of TaSe2, TaS2, NbSe2, CoS2, CoSe2, Fe and Co. Quantum oscillatory structure, charge density wave effects, and ferromagnetic band structure effects are being measured. Surface adsorption of single ring compounds, multi- ring compounds, as well as large polymeric molecules is being studied with inelastic electron tunneling.

RESULTS: In addition to previously reported results we have used quantum oscillatory measurements to delineate charge density wave modifications in 2H-TaSe2 and have extended the same type of measurement in 4Hb-TaS2. Results on surface molecular orientation and interaction, electron-phonon coupling, and uv molecular damage using inelastic electron tunneling have also been reported.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0040, EXTENDED X-RAY ABSORPTION FINE STRUCTURE
E.A. STERN, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DMR73-02521 A02)

Research using extended X-ray absorption fine structure (EXAFS) to determine atomic environments surrounding each type of atom in solids which was previously supported by NSF grant GH-41348 will be continued. The potential of EXAFS will be further developed and applied to specific problems in order to determine microscopic information concerning these systems. The following systems will be studied: biological and related porphyrin systems; the L-edge structure; anisotropic effects, in particular, using layered compounds; catalysts; and to catalog the EXAFS data for various environments using known systems which could then be used as standards to interpret unknown systems. Although most of the planned measurements are planned to be made at the Stanford Synchrotron source (SSRP), it is also planned to further develop EXAFS apparatus using conventional X-ray sources. There are certain measurements that can be made satisfactorily with conventional sources and also some preliminary measurements which would permit more efficient time use of the Stanford Synchrotron source.

SUPPORTED BY U.S. Natl. Science Foundation

8.0041, QUANTUM THEORY FOR REACTIVE AND DISSOCIATIVE ATOM-MOLECULE SCATTERINGS
K. TANG, Pacific Lutheran University, School of Arts & Sciences, *Tacoma, Washington* 98447 (CHE76-07412)

This project will develop an efficient way to make general three- dimensional quantum mechanical calculations of reactive and dissociative atom-molecule scattering. Dr. Tang's group has already developed the adiabatic distorted wave method for reactive scattering from ground initial state to arbitrary final state. Compared with the recent close- coupling calculation results of Schatz and Kupperman, this method seems to give the correct total and differential cross sections in the entire thermal energy region. Using the fact that the potential has to be rotationally invariant, they have analytically integrated out the three Euler angles describing the rotation of the whole system. Thus, the problem is reduced in complexity by more than two orders of magnitude as measured by the computer time required to carry out such calculations. In addition, Dr. Tang will refine and extend this model so that one can treat general reactive collisions with any rotational and vibrational transitions. For dissociative scattering, Dr. Tang will investigate the practical ways of using the formal theories of three-particle wave functions recently developed by E. Gerjuoy and R. Newton. The above reactive scattering model will be used as a framework for carrying out actual numerical calculations for collisionally-induced molecular dissociations.

SUPPORTED BY U.S. Natl. Science Foundation

8.0042, MAGNETIC AND DIELECTRIC PROPERTIES OF SOLIDS
M.S. SEEHRA, West Va. University, School of Arts & Sciences, *Morgantown, West Virginia* 26506 (DMR74-06684 A03)

Research on the magnetic and dielectric properties of solids, previously funded under GH-41126, will be continued. The program is composed of two parts, A and B. In part A the behavior of the Electron Paramagnetic Resonance (EPR) linewidth in the ferromagnet Gd near the Curie temperature will be investigated and magnetic susceptibility studies in single domain crystals of CaO and MgO will be performed. Some additional collaborative efforts on magnetostriction, spin-spin relaxation, and theory of EPR linewidth will be pursued. In part B, investigations into the dielectric and electrical properties of the mineral pyrite (FeS2), which is one of the main sources of sulfur in coals, will be made. These studies have a potential impact on the desulfurization of coal.

SUPPORTED BY U.S. Natl. Science Foundation

8.0043, SURFACE STRUCTURES OF SEMICONDUCTORS, LAYERED COMPOUNDS AND LARGE-MOLECULE OVERLAYERS
S.Y. TONG, Univ. of Wisconsin, School of Letters & Science, *Milwaukee, Wisconsin* 53221 (DMR73-02614 A01)

Calculational methods are being developed so that dynamical models may be used to treat the diffraction of low-energy electron beams by the species on and near the surfaces of solids. These calculational methods will then be used to interpret LEED (low-energy electron diffraction) data. Specifically, new methods will be set up for the 'reconstructed' layers of semiconducters, for transition-metal dichalcogenides (for example, molybdenum disulfide), layered compounds, and for organic molecules absorbed on metal surfaces. The surface properties of these systems are believed to be important in determining their properties for electronic devices, lubrication, topochemistry, and heterogeneous catalysis.

Surface crystallography of the dichalcogenides and of reconstructed semiconductors requires new theoretical methods because these compounds contain stacks of two or more closely spaced layers separated from other stacks by larger spacings, making the electron scattering intractable by presently available methods. The new method combines L-space and K- space representations. Interlayer multiple scattering between closely spaced layers is treated in the L-space representation. Scattering between widely spaced layers is solved by the Bloch beam approach.

Organic molecules adsorbed on transition-metal surfaces, and perhaps reconstructed semiconductor surfaces, involve nxn superlattices with 4 or more atoms per unit cell. Currently available methods are economically feasible for up to 2 atoms per unit cell in a p(2 times 2) overlayer structure. In the present work, an L-space iteration method is used.

SUPPORTED BY U.S. Natl. Science Foundation

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, JOINT USE OF SPECIALIZED RESOURCES TO SUPPORT LITERATURE SURVEILLANCE & BIBLIOGRAPHIC PREPARATION ON CHEMICAL EVOLUTION & ORIGIN OF LIFE
M. WEST, Calif. State Univ. & Colleges, School of Science, *San Jose, California* 95114 (NCA 2-675707)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

9.0002, OPERATION OF A SCIENTIFIC COMMUNICATION SYSTEM FOR PLANETARY QUARANTINE
M.C. HEAD, George Washington University, Graduate School, *Washington, District of Columbia* 20006 (NASW 3029)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, PHOTOELECTRIC OBSERVATIONS OF LUNAR OCCULTATIONS
N.M. WHITE, Lowell Observatory, *Flagstaff, Arizona* 86001 (AST76-82248)

Continuation of the Lowell photoelectric lunar occultation program will provide means of making three fundamental observations in the fields of celestial mechanics and astrophysics: 1) accurate positions of the moon relative to the stellar reference frame. 2) two- millisecond-of-arc resolution of very close multiple stellar systems, and 3) measurement of stellar angular diameters down to a few milliseconds of arc.

Observations of both reappearances and disappearances of stars at the moon's limb will be made. In addition to accurate timings, it is expected from past experience that 5 to 10 percent of the observation will show hitherto unresolved stellar components and that about 2 to 3 percent of the observations may give measurable angular diameters. Simultaneous multi-color observations with two or more telescopes will be made of all stars with measurable diameters. Complementary spectroscopic and near-infrared photometric observation will be made of all stars with angular diameters and some newly resolved double stars.

Prior support was by NSF grant AST 73-05269 A 01.

SUPPORTED BY U.S. Natl. Science Foundation

10.0002, EVALUATION OF NEW GENERATION OF FOURIER TRANSFORM SPECTROMETER THROUGH ENGINEERING FLIGHT TESTS ON THE KUIPER AIRBORNE OBSERVATORY
H.P. LARSON, Univ. of Arizona, Lunar & Planetary Laboratory, *Tucson, Arizona* 85721 (NCA 2-40701)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0003, OBSERVATION OF COMETS AND ATMOSPHERIC EXTINCTION
S. MARTINECK, Univ. of Arizona, Graduate School, *Tucson, Arizona* 85721 (NCA 5-76)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0004, AN INVESTIGATION OF THEORETICAL AND INSTRUMENTAL TECHNIQUES FOR THE STUDY OF INFRARED EMISSION LINE OBJECTS WITH AIRCRAFT-BASED TELESCOPES
R.I. THOMPSON, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (NCA 2-40702)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0005, SIMULTANEOUS X-RAY AND OPTICAL OBSERVATIONS OF THE 'SCO-X-1 LIKE' X-RAY SOURCES
C.S. BOWYER, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (NSG 5164)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0006, MILLIMETER WAVELENGTH OBSERVATIONS OF THE PLANETS
W.J. WELCH, Univ. of California, School of Engineering, *Berkeley, California* 94720 (NSG 2211)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0007, A SEARCH FOR SLOW X-RAY PULSARS FROM ORBITING ASTRONOMICAL OBSERVATORY COPERNICUS
B.H. MARGON, Calif. State Univ. & Colleges, Graduate School, *Los Angeles, California* 90032 (NSG 5165)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0008, PHYSICAL CONDITIONS, ABUNDANCES AND CHEMISTRY IN DIFFUSE INTERSTELLAR CLOUDS
M.A. JURA, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (NSG 5169)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0009, RARE EARTHS - INCLUSIONS FROM DIFFERENT CLASSES OF CARBONACEOUS CHRONDRITES
UNKNOWN, Univ. of California, Graduate School, *Los Angeles, California* 90024 (NSG 7335)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0010, INVESTIGATION OF PLANETARY SEARCH TECHNIQUE BY INFRARED INTERFEROMETRY
R.N. BRACEWELL, Stanford University, School of Engineering, *Palo Alto, California* 94305 (NCA 2-745716)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0011, HIGH RESOLUTION STUDIES OF DISCRETE RADIO SOURCES
M.H. COHEN, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST76-01619 A01)

High resolution studies of variable compact radio sources will be carried out using very long baseline interferometric (VLBI) methods. Two-dimensional maps of the sources will be made with an angular resolution of about 0.001 seconds of arc. The kinematics and motions of the sources will be used to determine the physical properties and energy mechanisms of the sources. A major effort will be made to study large extragalactic sources which contain compact nuclei. The experiments will include multi-station observations using the National Radio Astronomy Observatory, Owens Valley Radio Observatory, and the Harvard Radio Astronomy station at Ft. Davis, Texas. A multistation VLBI processor will be completed and run on the basis of being available to all interested users.

SUPPORTED BY U.S. Natl. Science Foundation

10.0012, RELATIVISTIC ASTROPHYSICS
J.E. GUNN, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (AST76-80801)

This proposal covers research in many different areas of astrophysics and relativity. The research will be primarily theoretical, but will also include observations and some aspects of experimental relativity. The topics to be studied include: (a) the large-scale structure and cosmological evolution of the universe; (b) the origin, structure, and evolution of galaxies and clusters of galaxies; (c) the dynamics of globular clusters and the distribution of masses for the oldest stars in the universe; (d) late stages of stellar evolution and the structures of giant stars that have neutron stars or black holes in their cores; (e) close binary star systems and their roles as compact X-ray sources; (f) gravitational collapse and black holes; (g) the theory of the generation of gravitational waves and plans for a search for gravitational waves using Doppler tracking of interplanetary spacecraft; (h) design studies for new experiments to test general relativity theory.

This action provides additional funding and extends the duration of the grant number AST 75-01398A01 for 12 months.

SUPPORTED BY U.S. Natl. Science Foundation

10.0013, DESIGN STUDY OF RADIO PHYSICS EXPERIMENT PREAMPLIFIERS
J.W. WARWICK, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (NAS 5-23771)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0014, SPECTROSCOPY OF ASTEROIDS
T.B. MCCORD, Univ. of Hawaii, Graduate School, *Honolulu, Hawaii* 96822 (NSG 7310)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0015, NUCLEAR ASTROPHYSICS AND THE ORIGIN OF THE ELEMENTS
D.N. SCHRAMM, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (AST76-21707)

This work will focus on the origin of the chemical elements and cosmic rays. Particular attention will be devoted to the latter stages of stellar evolution, gravitational collapse and supernovae explosions as well as the age and evolution of the elements in the Galaxy. Cosmological implications of nuclear astrophysics, such as the origin of deuterium and the age of the elements, will be examined. New developments in radioactive element dating will be applied to studies on the ages of galaxies and on the structure of the universe. These methods will be used for studies on the origin of the solar system. Weak interaction phenomena of importance to astrophysical situations will be examined. Nucleosynthesis sites in astronomical objects will be studied.

SUPPORTED BY U.S. Natl. Science Foundation

10.0016, RESEARCH ON COMETS
M.F. AHEARN, Univ. of Maryland, School of Agriculture, *College Park, Maryland* 20742 (NSG 7322)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0017, PLANETARY SPECKLE IMAGING
R.M. GOODY, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (NSG 7332)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0018, TWO-DIMENSIONAL CLASSIFICATION OF STARS SOUTH OF PLUS 20 DEGREES IN THE HENRY DRAPER CATALOGUE
C.R. COWLEY, Univ. of Michigan, School of Lit. Sci. & the Arts, *Ann Arbor, Michigan* 48104 (AST75-05915 A02)

Work will continue on providing a catalogue of accurate spectral and luminosity types for individual stars south of plus 20 degrees listed in the Henry Draper Catalogue. During the past year the majority of the more than 30,000 stars for Volume 2 (declinations between minus 55 degrees and minus 40 degrees) have been classified. During the first half of 1977, Volume 2 will be prepared for publication. Classification of stars for Volume 3 will be carried out at the same time. The remaining plates for regions accessible from the Cerro Tololo Inter- American Observatory will be obtained. In addition, some statistical analyses of Volume 2 will be made. This work is the second year of the two-year continuing grant AST 75-05915A01.

SUPPORTED BY U.S. Natl. Science Foundation

10.0019, COSMIC BACKGROUND EXPLORER SATELLITE MISSION DEFINITION STUDY
D.T. WILKINSON, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (NAS 5-24100)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0020, MULTIDISCIPLINARY RESEARCH IN THE SPACE STUDIES
W.S. BROECKER, Columbia University, School of Arts & Sciences, *New York, New York* 10027 (NSG 5163)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0021, SIMULTANEOUS OBSERVATIONS OF THE ULTRAVIOLET SPECTRUM, THE OPTICAL SPECTRUM AND THE OPTICAL POLARIZATION OF ORIONIS
D.E. HAYES, Columbia University, Lamont Doherty Geolog. Observ., *Palisades, New York* 10964 (NSG 5168)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0022, THEORETICAL PLANETARY PHYSICS
J.J. CALDWELL, State University of New York, Graduate School, *Stony Brook, New York* 11790 (NSG 7320)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0023, INVESTIGATION OF FLARE STARS
D.S. EVANS, Univ. of Texas, School of Arts & Sciences, *Austin, Texas* 78712 (AST75-03977 A01)

An extensive program of monitoring flare stars will be carried out. Photoelectric measurements of certain selected stars, such as UV Ceti and CM Draconis, will be made in order to test the extent to which membership in a binary system affects the flare phenomenon. A selection of early-type stars will also be monitored in order to extend the statistics of the flare phenomenon. Simultaneous photometric and spectroscopic studies with a time resolution of 5 to 10 seconds will be made of particular flares. Conventional photometry of certain known flare stars will be made in order to see if there are small periodic variations in luminosity. Multiple stellar systems which contain flare stars will be investigated in order to devise programs which may shed light on the origin and evolution of flare stars.

SUPPORTED BY U.S. Natl. Science Foundation

10.0024, COPERNICUS OBSERVATIONS OF STELLAR WINDS IN EARLY B-TYPE STARS
M.A. SMITH, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (NSG 5167)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0025, ANALYSIS OF DATA ON VERY HIGH ENERGY GALACTIC ELECTRONS
J.J. LORD, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (NSG 7318)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

GENERAL

11.0001, DEVELOPMENT AND IMPLEMENTATION OF A MINORITY INDUSTRIAL ASSISTANCE PROGRAM
UNKNOWN, Univ. of Southern California, Graduate School, *Los Angeles, California* 90007 (NASW 3009)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0002, ELEMENTS OF SEARCH STRATEGY FOR SETI
C.L. SEEGER, Calif. State Univ. & Colleges, Graduate School, *San Francisco, California* 94132 (NSG 2210)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0003, COLLECTION AND ANALYSIS OF INFORMATION RELATING TO TECHNOLOGY TRANSFER AND APPLICATION
UNKNOWN, Univ. of Denver, Graduate School, *Denver, Colorado* 80210 (NASW 3021)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0004, DEVELOP PLAN TO ASSEMBLE SAR/LANDSAT DATA SETS
P.E. ANUTA, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (NAS 6-2816)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0005, OPERATION OF A STATE TECHNICAL APPLICATION PROGRAM
UNKNOWN, Univ. of Kentucky, Graduate School, *Lexington, Kentucky* 40506 (NASW 3039)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0006, TECHNICAL SERVICE OPERATIONS AND MATERIALS FOR CATALOGUING BOOKS AND OTHER MATERIAL
J.P. LEWIS, Columbia University, Graduate School, *New York, New York* 10027 (NAS 5-24080)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0007, SYMPOSIUM ON AERONAUTICS AND SPACE AIMED AT MOTIVATING MINORITIES AND WOMEN TOWARD SCIENCE
G. THOMAS, Univ. of Oklahoma, Graduate School, *Norman, Oklahoma* 73069 (NASW 3020)

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01 AERONAUTICS (GENERAL)

N77-24052*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DYNAMICS OF ULTRALIGHT AIRCRAFT: MOTION IN VERTICAL GUSTS
Robert T. Jones Apr. 1977 12 p refs
(NASA-TM-X-73228; A-6947) Avail: NTIS HC A02/MF A01 CSCL 01A

Gust load calculations are extended to the range of conditions encountered by ultralight aircraft such as hang gliders. Having wing loadings of the order of 5 kg/sq m, these gliders acquire a substantial fraction of the motion of a gust within a distance of 1 or 2 m. Comparative loads and displacements for a small powered airplane having a wing loading of 50 kg sq m and for a commercial jet with 500 kg sq m are shown. Author

N77-24053*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DYNAMICS OF ULTRALIGHT AIRCRAFT: DIVE RECOVERY OF HANG GLIDERS
Robert T. Jones May 1977 15 p refs
(NASA-TM-X-73229; A-6989) Avail: NTIS HC A02/MF A01 CSCL 01A

Longitudinal control of a hang glider by weight shift is not always adequate for recovery from a vertical dive. According to Lanchester's phugoid theory, recovery from rest to horizontal flight ought to be possible within a distance equal to three times the height of fall needed to acquire level flight velocity. A hang glider, having a wing loading of 5 kg sq m and capable of developing a lift coefficient of 1.0, should recover to horizontal flight within a vertical distance of about 12 m. The minimum recovery distance can be closely approached if the glider is equipped with a small all-moveable tail surface having sufficient upward deflection. Author

N77-24054# RCA Government and Commercial Systems, Burlington, Mass. Automated Systems Div.
FIELD EVALUATION OF UH-1 HELICOPTER INSPECTION SYSTEMS. PROJECT INSPECT, PHASE 2 Final Report, 1 May 1974 - 31 May 1976
Fred W. Hohn, Bruce B. Wierenga et al Nov. 1976 248 p refs
(Contract DAAJ02-74-C-0044)
(AD-A033721; USAAMRDL-TR-76-27) Avail: NTIS HC A11/MF A01 CSCL 15/5

Project Inspect was established to analyze aircraft maintenance scheduled inspections and to design an improved schedule inspection scheme that will function effectively in the era of the volunteer Army. Various priorities associated with preventive maintenance scheduled inspection systems of Army aircraft were studied, and the resulting restructuring of these systems is based on the analysis of historical data and the modeling results of a developed computer program, MAVIS (Model for Analysis of Vehicle Inspection Systems). The output of this effort indicated that proper scheduling of individual component inspections based on failure and failure detection historical data permits an increase in inspection intervals, resulting in increased efficiency and maintenance cost savings. Project Inspect then developed a phased checklist for the UH-1H Helicopter. The implementation of a scientifically derived phased inspection schedule with opened intervals should result in greater inspection efficiency, reduced maintenance costs, and increased operational readiness. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N77-24055*# Kaman Aerospace Corp., Bloomfield, Conn.
DESIGN STUDY OF A FEEDBACK CONTROL SYSTEM FOR THE MULTICYCLIC FLAP SYSTEM ROTOR (MFS) Final Report
R. Weisbrich, R. Perley, and H. Howes 21 Jan. 1977 90 p refs
(Contract NAS2-8726)
(NASA-CR-151960; R-1494) Avail: NTIS HC A05/MF A01 CSCL 01A

The feasibility of automatically providing higher harmonic control to a deflectable control flap at the tip of a helicopter rotor blade through feedback of selected independent parameter was investigated. Control parameters were selected for input to the feedback system. A preliminary circuit was designed to condition the selected parameters, weigh limiting factors, and provide a proper output signal to the multi-cyclic control actuators. Results indicate that feedback control for the higher harmonic is feasible; however, design for a flight system requires an extension of the present analysis which was done for one flight condition - 120 kts, 11,500 lbs gross weight and level flight. Author

N77-24056*# Kanner (Leo) Associates, Redwood City, Calif.
QUANTITATIVE STUDY OF THREE-DIMENSIONAL FLOW FIELDS AROUND FLIGHT VEHICLES IN THE CASE OF SUPERSONIC FLOW BY MEANS OF OPTICAL METHODS
G. Schwarz Washington NASA May 1977 24 p refs Transl. into ENGLISH of paper 76-172, presented at the 9th Ann. Congr. of the Ger. Soc. for Aeron. and Astronautics, Munich, 14-16 Sep. 1976 16 p
(Contract NASw-2790)
(NASA-TT-F-17428) Avail: NTIS HC A02/MF A01 CSCL 01A

Asymmetrical, three dimensional density fields around bodies in a supersonic flow are evaluated using interferograms, schlieren photography and tinged photographs. Author

N77-24057*# McDonnell-Douglas Corp., Long Beach, Calif.
A COMPUTER PROGRAM FOR CALCULATING THREE-

DIMENSIONAL COMPRESSIBLE LAMINAR AND TURBULENT BOUNDARY LAYERS ON ARBITRARY WINGS
Tuncer Cebeci, Kalle Kaups, and Judy A. Ramsey May 1977 64 p refs Sponsored by NASA
(NASA-CR-145194) Avail: NTIS HC A04/MF A01 CSCL 01A

A computer program for calculating three dimensional compressible laminar and turbulent boundary layers on arbitrary wings is described and presented. The computer program consists of three separate programs, namely, a geometry program to represent the wing analytically, a velocity program to compute the external velocity components from a given experimental pressure distribution and a finite difference boundary layer method to solve the governing equations for compressible flows. To illustrate the usage of the computer program, three different test cases are presented and the preparation of the input data as well as the computed output data is discussed in some detail. Author

N77-24058*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSITION AND LAMINAR INSTABILITY
Leslie M. Mack 15 May 1977 84 p refs
(Contract NAS7-100)
(NASA-CR-153203; JPL-Publ-77-15) Avail: NTIS HC A05/MF A01 CSCL 01A

The linear stability theory was applied to the problem of boundary layer transition in incompressible flow. The theory was put into a form suitable for three-dimensional boundary layers; both the temporal and spatial theories were examined; and a generalized Gaster relation for three-dimensional boundary layers was derived. Numerical examples include the stability characteristics of Falkner-Skan boundary layers, the accuracy of the two-dimensional Gaster relation for these boundary layers, and the magnitude and direction of the group velocity for oblique waves in the Blasius boundary layer. Available experiments which bear on the validity of stability theory and its relation to transition are reviewed and the stability theory is applied to transition prediction. The amplitude method is described in which the wide band disturbance amplitude in the boundary layer is estimated from stability theory and an interaction relation for the initial amplitude density of the most unstable frequency.

N77-24059*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL STUDY OF THE EFFECT OF GROUND PROXIMITY ON THE INDUCED EFFICIENCY OF HELICOPTER ROTORS
Harry H. Heyson 3 May 1977 90 p refs
(NASA-TM-X-71951) Avail: NTIS HC A05/MF A01 CSCL 01A

A study of rotors in forward flight within ground effect showed that the ground-induced interference is an upwash and a decrease in forward velocity. The interference velocities are large, oppose the normal flow through the rotor, and have large effects on the induced efficiency. Hovering with small ground clearances may result in significant blade stall. As speed is increased from hover in ground effect, power initially increases rather than decreases. At very low heights above the ground, the power requirements become nonlinear with speed as a result of the streamwise interference. The streamwise interference becomes greater as the wake approaches the ground and eventually distorts the wake to form the ground vortex which contributes to certain observed directional stability problems. Author

N77-24060*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INVESTIGATION OF INLET CONCEPTS FOR MANEUVER IMPROVEMENT AT TRANSONIC SPEEDS
Eldon Latham, John Gawienowski, and Frank Meriwether Apr. 1977 61 p ref
(NASA-TM-X-73215; A-6952) Avail: NTIS HC A04/MF A01 CSCL 01A

A 15 percent scale lightweight fighter type inlet forebody was tested in the Ames 14 foot transonic wind tunnel at Mach numbers of 0.7, 0.9, and 1.04. The inlet was a two dimensional horizontal ramp system designed for a Mach number of 2.2. Four inlet devices designed to prevent or delay cowl-lip boundary layer separation or to improve the inlet internal flow characteristics at high angles of attack were investigated. The devices used to control cowl-lip separation consisted of cowl leading edge flaps, slotted flaps, and tangential blowing. To improve the internal flow characteristics, discrete jet nozzle flows were directed downstream and parallel to the duct surface in the subsonic diffuser to energize the wall boundary layer. The discrete jets used in the subsonic diffuser were also tested in combination with each of the cowl leading edge devices. Test measurements included engine-face total pressure recovery, steady state distortion, dynamic distortion, duct boundary layer profiles, and duct-surface static pressures. Author

N77-24061*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS AT MACH 6 OF A HYPERSONIC RESEARCH AIRPLANE CONCEPT HAVING A 70 DEG SWEPT DELTA WING
Louis E. Clark and Christine B. Richie Washington May 1977 60 p refs
(NASA-TM-X-3475; L-10712) Avail: NTIS HC A04/MF A01 CSCL 01A

The hypersonic aerodynamic characteristics of an air-launched, delta-wing research aircraft concept were investigated at Mach 6. The effect of various components such as nose shape, wing camber, wing location, center vertical tail, wing tip fins, forward delta wing, engine nacelle, and speed brakes was also studied. Tests were conducted with a 0.021 scale model at a Reynolds number, based on model length, of 10.5 million and over an angel of attack range from -4 deg to 20 deg. Results show that most configurations with a center vertical tail have static longitudinal stability at trim, static directional stability at angles of attack up to 12 deg, and static lateral stability throughout the angle of attack range. Configurations with wing tip fins generally have static longitudinal stability at trim, have lateral stability at angles of attack above 8 deg, and are directionally unstable over the angle of attack range. Author

N77-24062*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATIONS, AND COMPARISON WITH AN IDEAL MINIMUM, OF TRIMMED DRAG FOR CONVENTIONAL AND CANARD CONFIGURATIONS HAVING VARIOUS LEVELS OF STATIC STABILITY
Milton D. McLaughlin Washington May 1977 24 p refs
(NASA-TN-D-8391; L-11016) Avail: NTIS HC A02/MF A01 CSCL 01A

Classical drag equations were used to calculate total and induced drag and ratios of stabilizer lift to wing lift for a variety of conventional and canard configurations. The Flight efficiencies of such configurations that are trimmed in pitch and have various values of static margin are evaluated. Classical calculation methods are compared with more modern lifting surface theory. Author

N77-24063# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
WIND TUNNEL MEASUREMENTS IN THE BOUNDARY LAYER ON A 3-D SWEPT WING Final Report
A. Bertelrud 1976 112 p refs
(Contracts F-INK-82223-74-001-07-001; F-INK-82223-75-007-07-001; F-INK-82223-76-001-21-001)
(FFA-TN-AU-1191) Avail: NTIS HC A06/MF A01

Measurements in a low speed wind tunnel are reported. The tests are part of a project concerning extrapolation from wind tunnel to flight, and comparative flight tests are planned. The wing was the outer part of the actual wing of a SAAB 32 Lansen attack aircraft and had natural service roughness. The wing was tested at angles of attack from zero to 12 deg (geometrical), and in a unit Reynolds number range of 0.7 to 3.4x10 to the 6th power. Some wake profile measurements are also included. Flow visualizations showed that the surface streamlines were approximately straight and parallel, and from other smoke and tuft tests (at various surface distances) the velocity profiles appear to have only moderate crossflow components. The profiles were measured by means of total head rakes and the local skin friction was measured with Preston tubes and surface total head/static probes. The results indicated that these two methods differ from the Clauser chart generally by less than 5%, despite relatively strong pressure gradients.

The wing had leading edge separation type, and tests with tape as transition trip near the leading edge explained some phenomena observed in earlier flight tests with aircraft of the same type.
Author (ESA)

N77-24064# European Space Agency, Paris (France).
SHOCK RECOMPRESSION OF A SUPERSONIC INTERNAL FLOW IN THE PRESENCE OF A BOUNDARY LAYER BLEED
Georges Meauze Mar. 1977 78 p refs Transl. into ENGLISH of 'Recompression par Choc d'un Ecoulement Interne Supersonique en Presence d'un Piege a Couche Limite', ONERA, Paris Report ONERA-NT-1976-8, 1976 Original report in FRENCH previously announced as N77-20388
(ESA-TT-369; ONERA-NT-1976-8) Avail: NTIS HC A05/MF A01

To improve the understanding of the functioning of a boundary layer bleed in a supersonic, internal compression, air intake, with particular regard to the influence of various design parameters on recompression efficiency and stability, an experimental facility was made which incorporates a high degree of flexibility. In the experimental model the particular problem of the boundary layer bleed was separated from the general study of the supersonic air intake by creating, in a nozzle, a flow at the Mach number reached at the end of the internal recompression in a supersonic intake thus eliminating all phenomena occurring before the bleed. Various shapes of bleed were tested at Mach number 1.12, 1.42, and 1.72. The experiments made it possible to propose a simple theoretical model from which a calculation method was developed. The theoretical method is shown to predict the experimental results and allow optimization, for a given entry upstream flow, of the bleed geometry. Author (ESA)

N77-24065# European Space Agency, Paris (France).
UNSTEADY PRESSURE MEASUREMENTS IN ROTOR BLADE TIPS WITH INCIDENCE IN INCOMPRESSIBLE FLOW
Hermann Triebstein Apr. 1977 58 p refs Transl. into ENGLISH of 'Instationaere Druckverteilungsmessungen an angestellten Rotorblattspitzen in inkompressibler Stroemung', DFVLR, Goettingen, West Ger. Report DLR-FB-76-42, 11 Aug. 1976 Original report in GERMAN previously announced as N77-20038 Original German report available from DFVLR, Cologne DM 28.70
(ESA-TT-374; DLR-FB-76-42) Avail: NTIS HC A04/MF A01

The measurement of unsteady pressure on harmonically oscillating rotor blade tips, in incompressible subsonic flow is dealt with. The measurements were made in a subsonic wind tunnel. The pressure was measured in five sections, allowing the three-dimensionality of the pressure distributions to be well observed. The flow speed was V = 45 m/s and the oscillation frequencies were f = 2, 4, and 6 Hz. The oscillation amplitudes ran from B = 1 to 3 deg and the angles of attack were 0, 3, 6, 9, and 12 deg. Test facilities are described. Author (ESA)

N77-24066# European Space Agency, Paris (France).
INFLUENCE OF THE BOUNDARY LAYER THICKNESS ON THE BASE PRESSURE IN TWO-DIMENSIONAL AND AXISYMMETRIC SUPERSONIC FLOWS
Mauri Tanner Apr. 1977 32 p refs Transl. into ENGLISH of 'Einfluss der Grenzschichtdicke auf den Basisdruck bei zweidimensionaler u. rotationssymmetrischer Ueberschallstroemung', DFVLR, Goettingen, West Ger. Report DLR-FB-76-43, 12 Aug. 1976 Original report in GERMAN previously announced as N77-20039 Original German report available from DFVLR, Cologne DM 18.60
(ESA-TT-375; DLR-FB-76-43) Avail: NTIS HC A03/MF A01

Equations were developed for the prediction of the influence of the boundary layer thickness on the base pressure in two-dimensional and axisymmetric supersonic flow. Results show that, for an equal increment of the boundary layer thickness, the increase of the base pressure is smaller when the Mach number becomes greater. Author (ESA)

N77-24067# European Space Agency, Paris (France).
CALCULATION OF THE PRESSURE DISTRIBUTION ON HARMONICALLY OSCILLATING BODIES IN INCOMPRESSIBLE FLOW
Wolfgang Geissler Apr. 1977 37 p refs Transl. into ENGLISH of 'Berechnung der Druckverteilung an harmonisch oszillierenden dicken Ruempfen in inkompressibler Stroemung', DFVLR, Goettingen, West Ger. Report DLR-FB-76-48, 3 Oct. 1976 Original report in GERMAN previously announced as N77-20040 Original German report available from DFVLR, Cologne DM 17.90
(ESA-TT-376; DLR-FB-76-48) Avail: NTIS HC A03/MF A01

A numerical method to calculate pressure distributions on thick axisymmetric bodies oscillating in pitching and plunging modes in a parallel flow is presented. A static angle of attack is taken into account for the unsteady calculations. It is not assumed that the amplitudes of oscillation are small compared to a characteristic body length. The method uses arbitrary source-sink distributions on the real body surface. The geometrical boundary condition and the Bernoulli equation for the calculation of pressures are nonlinearized. Besides determination of steady pressures and unsteady pressures of the first harmonic it is shown that the method can be used to calculate the second and higher harmonics of the unsteady motion. Author (ESA)

N77-24068# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
STABILITY AND CONTROL CHARACTERISTICS OF THE WINGLET CONFIGURED KC-135A M.S. Thesis
Kent R. Crenshaw Dec. 1976 193 p refs
(AD-A034940; GAE/MC/76D-5) Avail: NTIS HC A09/MF A01 CSCL 01/3

Using the Boeing FLEXSTAB digital computer system, rigid and elastic models of the winglet configured KC-135A are made. With a rigid analysis, the winglets reduce total drag from 2 to almost 8% with improvements both laterally and longitudinally in static stability. Dynamically, the rigid winglet model is more stable laterally but slightly more oscillatory longitudinally. The lateral dutch roll mode damping ratio increased with winglets from 3 to 12% with only a 3% increase in frequency. Elastic static stability is still improved both laterally and longitudinally with winglets; and dynamically, the winglets improve lateral stability with very little effect longitudinally. With aeroelastic effects, the overall benefit derived from winglet application to the model is less. However, no significant detrimental effects due to winglets are found. GRA

N77-24069# TRW Defense and Space Systems Group, Redondo Beach, Calif.
AN INVESTIGATION OF NOSE BLUNTNESS EFFECTS ON TRANSITION ASYMMETRY AND TRANSITION AERODYNAMICS Final Report, May - Sep. 1976
Gerald Gustafson 30 Sep. 1976 42 p refs
(Contract F04701-75-C-0163)
(AD-A033886; TRW-28513-6014-RU-00; SAMSO-TR-76-102) Avail: NTIS HC A03/MF A01 CSCL 01/1

The effects of wind fixed boundary layer transition on reentry vehicle aerodynamics plays an important role in determining high altitude trajectory dispersions. An investigation was undertaken to determine the effects of nose bluntness on boundary layer transition asymmetry and transitional aerodynamic perturbations at angle of attack. The results of previous experimental investigations of asymmetric transition are reviewed. An experimental program using the Calspan 96-inch shock tunnel to investigate bluntness effects on transition asymmetry and related aerodynamic perturbations is discussed. Data from the test program will be published in a future report. Author (GRA)

N77-24070# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
AN EXPERIMENTAL INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF NOSE MOUNTED CANARD CONFIGURATIONS AT SUPERSONIC MACH NUMBERS (1.5 THROUGH 4.5)
James R. Burt, Jr. 10 Oct. 1976 352 p
(DA Proj. 1M3-62303-A214)
(AD-A033783; RD-77-5) Avail: NTIS HC A16/MF A01 CSCL 20/4

Experimental aerodynamic investigations were conducted in a supersonic wind tunnel to determine the aerodynamic characteristics of several nose mounted canard wing configurations. Canard position, geometry, angular orientation, and model nose shape were varied systematically to determine their effects

on model aerodynamics. The model was tested at angles of attack of -5 to 13 degrees and Mach numbers of 1.5 to 4.5. Aerodynamic loads were measured separately on four canards and tail panels, and the total model. The vapor screen method was used to trace the paths of the vortices shed from the canards. Roll control effectiveness of canards, both with a planar tail and a ring tail was investigated. GRA

N77-24071# Mississippi State Univ., Mississippi State. Dept. of Aerophysics and Aerospace Engineering.
AN IMPROVED ALGEBRAIC RELATION FOR THE CALCULATION OF REYNOLDS STRESSES Interim Report
Z. U. Warsi and B. B. Amlicke Nov. 1976 10 p refs
(Grant AF-AFOSR-2922-76)
(AD-A033655; AASE-76-156; AFOSR-76-1240TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

In this paper an algebraic relation for the Reynolds Stresses has been obtained through a consideration of the transport equations of the Reynolds Stresses. This analysis provides a second-order approximation to the Boussinesq eddy viscosity hypothesis. The basic assumption of the analysis is that the derivatives of the ratio of the Reynolds Stresses and energy is small in comparison with the other terms. Author (GRA)

N77-24072# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
SUDDEN DECELERATION OF A FREE JET AT THE ENTRANCE OF A CHANNEL Interim Report
Roger W. Gallington Jan. 1976 16 p refs
(AD-A033659; DTNSRDC/ASED-350) Avail: NTIS HC A02/MF A01 CSCL 20/4

A family of two-dimensional potential flows is derived which may describe the interaction of a propulsion jet with the leading edge of a thin wing-in-ground effect at zero angle of attack with a deflected trailing edge flap. Assuming that such flows occur at the leading edge, the static performances of this arrangement-called the power augmented ram wing-are derived as functions of geometry. A minimum power point is found for given thrust and lift. At this minimum power point, the wing can be held about one-tenth of its chord above the surface while providing a lift force of about six times the installed thrust and recovering about four-fifths of the installed thrust.
Author (GRA)

N77-24073# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
THEORY OF POWER AUGMENTED RAM LIFT AT ZERO FORWARD SPEED Interim Report
Harvey R. Chaplin and Harvey R. Chaplin Feb. 1976 14 p refs
(AD-A033673; DTNSRDC/ASED-365) Avail: NTIS HC A02/MF A01 CSCL 20/4

Recent experiments by Huffman and Jackson demonstrated the possibility of an air cushion operating mode for an aircraft with low aspect ratio endplated wings wherein the propulsion system is mounted forward of the wing and exhausted into the space between the wing and the ground to generate high pressures for wing lift at zero forward speed. Gallington has derived two-dimensional potential flows relevant to this phenomenon, but applying to larger ratios of propulsive jet area to leading edge air gap area (height of wing above ground times wing span) than were employed in the experiments. In this report, simple momentum theory is applied to obtain performance estimates for a range of jet area ratios from zero to the limiting cases of the potential flow solutions. Reasonable agreement with experiment is found, suggesting that two-dimensional flow models may give useful estimates of the performance potential of such systems. It is found that, under conditions such that a large fraction of the propulsion system thrust is recovered as useful propulsive thrust, the ratio of lift to thrust is very sensitive to the jet area ratio and optimum performance is obtained for jet area ratios approaching unity. Additional experiments are needed, covering the full range of jet area ratios, to evaluate the practical potential of power augmented ram lift systems.
Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N77-24074*# Lockheed-California Co., Burbank.
STUDY OF THE IMPACT OF CRUISE SPEED ON SCHEDULING AND PRODUCTIVITY OF COMMERCIAL TRANSPORT AIRCRAFT Final Report, Jun. 1976 - Mar. 1977
E. Q. Bond, E. A. Carroll, and R. A. Flume Apr. 1977 108 p Prepared in cooperation with Trans World Airlines, Inc., Kansas City, Mo. and Braniff International
(Contract NAS1-14435)
(NASA-CR-145189; LR-28114) Avail: NTIS HC A06/MF A01 CSCL 01C

A comparison is made between airplane productivity and utilization levels derived from commercial airline type schedules which were developed for two subsonic and four supersonic cruise speed aircraft. The cruise speed component is the only difference between the schedules which are based on 1995 passenger demand forecasts. Productivity-to-speed relationships were determined for the three discrete route systems: North Atlantic, Trans-Pacific, and North-South America. Selected combinations of these route systems were also studied. Other areas affecting the productivity-to-speed relationship such as aircraft design range and scheduled turn time were examined.
Author

N77-24075# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT. CIVIL AVIATION, ISSUE NUMBER 2, 1976 ACCIDENTS
15 Dec. 1976 519 p
(NTSB-BA-76-7) Avail: NTIS HC A22/MF A01

The facts, conditions, circumstances, and probable causes of 899 randomly selected general aviation accidents occurring in U.S. civil aviation operations during calendar year 1976 are described in brief format. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N77-24076*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 15 Oct. 1976 - 14 Jan. 1977
Washington May 1977 74 p refs Prepared in cooperation with Battelle Columbus Labs., Mountain View, Calif.
(NASA-TM-X-3546; A-7001) Avail: NTIS HC A04/MF A01 CSCL 01C

During the third quarter of operation of the Aviation Safety Reporting System (ASRS), 1429 reports concerning aviation safety were received from pilots, air traffic controllers, and others in the national aviation system. Details of the administration and results of the program are discussed. The design and construction of the ASRS data base are briefly presented. Altitude deviations and potential aircraft conflicts associated with misunderstood clearances were studied and the results are discussed. Summary data regarding alert bulletins, examples of alert bulletins and responses to them, and a sample of deidentified ASRS reports are provided. Author

N77-24077# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
DEVELOPMENT OF A HYDROFLUIDIC VERNIER ROCKET CONTROL SYSTEM FOR EJECTION SEAT STABILIZATION Final Report, 1 Mar. - 1 Nov. 1976
R. V. Burton and R. B. Beale Dec. 1976 63 p refs
(Contract N00019-76-C-0374; WF53532403)
(AD-A034543; F0440-FR; Honeywell-77-SRC/1) Avail: NTIS HC A04/MF A01 CSCL 01/3

A feasibility demonstration model of a fluidic thrust vector control (FTVC) system was designed, fabricated, and tested for pitch stabilization of ejection seats using the STAPAC vernier

rocket. The control system includes a rate sensor, amplifier, attitude memory, and a position-controlled hydrofluidic servoactuator. The measured dynamic response of the control system closely matched the theoretical specifications for stable attitude control of the seat. The hardware was tested on a hydraulic rate table without rocket firing. Author (GRA)

N77-24078# Air Force Armament Lab., Eglin AFB, Fla.
INVESTIGATION OF POSSIBLE FIN FAILURES OF GBU-10 AND GBU-12 BOMBS CARRIED ON THE INBOARD WING STATION OF AN F-4 AIRCRAFT
Alfred V. Marrin Aug. 1976 303 p refs
(AD-A033340; AFATL-TR-76-85) Avail: NTIS HC A14/MF A01 CSCL 19/4

This report documents a study performed to isolate the cause of a collision between an F-4 aircraft and a GBU-12 bomb. The study was generalized to predict the resulting GBU-10 bomb trajectory conditions. Author (GRA)

N77-24079# Simat, Helliesen and Eichner, Inc., Washington, D. C.
AN ANALYSIS OF THE EFFECTS OF ROUTE RESTRICTION REMOVAL AND DISCRETIONARY AUTHORITY: THE TRANSITION TO A LESS-REGULATED ENVIRONMENT, VOLUME 1
Jan. 1977 147 p refs 3 Vol.
(Contract DOT-OS-60155)
(PB-263685/0; DOT/RAD-12-Vol-1) Avail: NTIS HC A07/MF A01; also available in set of 3 reports, PB-263684-SET, HC E21 CSCL 01B

The consequences to be expected during a transition to greater competition in scheduled interstate air transportation are considered. The conditions studied included the removal of all the certificate restrictions the CAB has placed on existing carriers and, simultaneously, a limited discretionary expansion of carriers' existing route structures. A profile of each trunk line and local service carrier was developed. The consequences of probably entry and exit scenarios were projected for each carrier, for each of the markets it serves, in terms of load factors, ASM', PRM's, and flight frequencies. GRA

N77-24080# Simat, Helliesen and Eichner, Inc., Washington, D. C.
AN ANALYSIS OF THE EFFECTS OF ROUTE RESTRICTION REMOVAL AND DISCRETIONARY AUTHORITY: THE TRANSITION TO A LESS-REGULATED ENVIRONMENT. VOLUME 2: TRUCK AIRLINE Final Report
Jan. 1977 508 p refs 2 Vol.
(Contract DOT-OS-60155)
(PB-263686/8; DOT/RAD-12-Vol-2) Avail: NTIS HC A22/MF A01; also available in set of 3 reports, PB-263684-SET, HC C21 CSCL 01B

The consequences to be expected during a transition to greater competition in scheduled interstate air transportation is discussed. Profiles identify, by market, each carrier's vulnerability to entry on its routes by other carriers, and the corresponding opportunities it in turn has to enter new markets. Profiles of trunk line carriers are reported. GRA

N77-24081# Simat, Helliesen and Eichner, Inc., Washington, D. C.
AN ANALYSIS OF THE EFFECTS OF ROUTE RESTRICTION REMOVAL AND DISCRETIONARY AUTHORITY: THE TRANSITION TO A LESS-REGULATED ENVIRONMENT. VOLUME 3: LOCAL SERVICE CARRIER PROFILES Final Report
Jan. 1977 327 p refs 3 Vol.
(Contract DOT-OS-60155)
(PB-263687/6; DOT/RAD-12-Vol-3) Avail: NTIS HC A15/MF A01; also available in set of 3 reports, PB-263684-SET, HC E21 CSCL 01B

Competition, traffic profiles, productivity, and market relations of local service air carriers are studied. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N77-24082*# Champlain Technology, Inc., West Palm Beach, Fla.
AN AVIONICS SENSITIVITY STUDY. VOLUME 1: OPERATIONAL CONSIDERATIONS Final Report, Aug. 1975 - Sep. 1976
Ronald W. Scott and Edwin D. McConkey Sep. 1976 230 p refs Prepared for Systems Control, Inc., Palo Alto, Calif.
(Contract NAS1-14144)
(NASA-CR-145107) Avail: NTIS HC A11/MF A01 CSCL 17G

Equipment and operational concepts affecting aircraft in the terminal area are reported. Curved approach applications and modified climb and descent procedures for minimum fuel consumption are considered. The curved approach study involves the application of MLS guidance to enable execution of the current visual approach to Washington National Airport under instrument flight conditions. The operational significance and the flight path control requirements involved in the application of curved approach paths to this situation are considered. Alternative flight path control regimes are considered to achieve minimum fuel consumption subject to constraints related to air traffic control requirements, flight crew and passenger reactions, and airframe and powerplant limitations. Author

N77-24083*# Systems Control, Inc., Palo Alto, Calif.
AN AVIONICS SENSITIVITY STUDY. VOLUME 2: EVALUATION OF AIRBORNE NAVIGATION SYSTEM PERFORMANCE DURING RNAV/MLS TRANSITION Final Report, Aug. 1975 - Sep. 1976
Walter Heine Sep. 1976 115 p refs
(Contract NAS1-14144)
(NASA-CR-145108) Avail: NTIS HC A06/MF A01 CSCL 17G

A computer simulation was modified to generate a suitable data base for performance of an avionics sensitivity study during RNAV/MLS transition. The avionics sensitivity data provides information necessary to establish requirements for additional guidance law design during transition and to establish airspace requirements for maneuvering to null out any residual RNAV errors upon MLS transition. The data base is also beneficial as planning information for subsequent flight testing. Author

N77-24084*# Systems Control, Inc., Palo Alto, Calif.
AN AVIONICS SENSITIVITY STUDY. VOLUME 3: AUTOMATED RNAV/MLS TRANSITION
Jaxant S. Karmarkar Mar. 1977 36 p refs
(Contract NAS1-14144)
(NASA-CR-145109) Avail: NTIS HC A03/MF A01 CSCL 17G

An automated algorithm for transitioning from RNAV to MLS is described. The algorithm generates guidance commands to enable the pilot to automatically switch from RNAV to MLS and effectively correct any offset errors during this transition. Software/hardware implementation details pertinent to the TCV Boeing 737 avionics are also considered. Author

N77-24085*# Kanner (Leo) Associates, Redwood City, Calif.
METHOD AND APPARATUS TO SHUT OUT INTERFERENCE FROM THE VERTICAL COMPONENT OF THE GEOMAGNETIC FIELD IN COMPASSES AND EARTH INDUCTORS
L. Schaetz NASA Washington May 1977 14 p Transl. into ENGLISH of German patent, Verfahren und Einrichtungen zum Ausschalten storendor Einwirkungen der Vertikalkomponente des erdmagnetischen Feldes auf Kompasse, Erdinduktoren und dergl. Reichspatentamt Patentschrift no. 666 594 class 42c, Group 32.10, a 80977 IX/42 c 6 p
(Contract NASw-2790)

(NASA-TT-F-17546) Avail: NTIS HC A02/MF A01 CSCL 17G

A method and apparatus to avoid the interference of the vertical component of the earth's magnetic field in direction or course indication devices, the reading of which is determined by the direction of the horizontal component of the earth's magnetic field is described. Author

N77-24086*# Kanner (Leo) Associates, Redwood City, Calif.
STATIC, NON-SWINGING ARRANGEMENT FOR DETERMINING COURSE ON BOARD A VEHICLE
J. Devaud Washington NASA May 1977 15 p Transl. into ENGLISH of "Statische, nicht pendelnde vorrichtung zur bestimmung des kurses an bord eines fahrzeugs", Deutsches patentamt offenlegungsschrift 2 400 002, 2 Jan. 1974 18 p
(Contract NASw-2790)
(NASA-TT-F-17547) Avail: NTIS HC A02/MF A01 CSCL 17G

A static non-swinging course indicator was designed which is comprised of a three axis magnetometer, a vertical gyroscope, and a computer. The instrument is so characterized that the magnetometer has on each axis a single coil with a saturable core which is connected to a direct current proportional to the component of the magnetic field along each individual axis. Author

N77-24087# National Aviation Facilities Experimental Center, Atlantic City, N. J.
APPLICATIONS OF THE SIMULATION MODEL FOR AIR TRAFFIC CONTROL COMMUNICATIONS Interim Report, Jul. 1974 - Jul. 1975
J. Stuart Hunter and D. A. Hsu Feb. 1977 254 p refs
Prepared in cooperation with Princeton Univ.
(Contract DOT-FA72NA-741)
(AD-A036738; FAA-NA-75-180; FAA-RD-76-19) Avail: NTIS HC A12/MF A01 CSCL 17/7

The simulation program for air traffic control (ATC) communications, its structure, validation, and applications is reviewed. The model, constructed using ATC communications data from the New York Center, was checked against ATC communications data from Houston with excellent results. Studies of the applications of the model are described with respect to communications capacity and queuing, the effects of reducing the number of transmissions per transaction, the effects of tone-bursts of different duration, and the sensitivity of communication responses to changes in various input variables. The construction of general simulations for sector types, as opposed to individual sectors, is described. Queuing time analyses and forecasting for ATC communications are reported. Author

N77-24088# Systems Control, Inc., Palo Alto, Calif. Champlain Technology Industries.
TERMINAL AREA DESIGN: ANALYSIS AND VALIDATION OF RNAU TASK FORCE CONCEPTS Final Report
E. D. McConkey Oct. 1975 542 p refs
(Contract DOT-FA72WA-3098)
(AD-A037022; FAA-RD-76-194) Avail: NTIS HC A23/MF A01 CSCL 17/7

Area navigation (RNAV) terminal area design guidelines for application to medium and high density terminal areas are presented. The design concepts proposed by the FAA/Industry RNAV Task Force were utilized in the development of initial time-phased 2d terminal area designs for Chicago, Denver, Miami, New Orleans, New York, Philadelphia, and San Francisco. The time phases correspond to three time periods. The 1972 to 1977 to 19 and 1977 82 transition period design were analyzed in conjunction with a real time simulation to confirm the pilots' and controllers' capability to operate efficiently in a mixed VOR/RNAV environment. The post-1982 designs were subjected to a user economic impact analysis to determine the effects of route length and altitude restrictions on fuel and time. Two 100 percent fixed gradient VNAV designs were developed for New York and New Orleans using task force concepts and were analyzed for their impact on the user and the system. Author

N77-24089# Cutler-Hammer, Inc., Deer Park, N.Y. AIL Div.
WIDE APERTURE (DIGITAL) VOR SYSTEM, PHASE 1 Final Report
Girt C. Kundzins and Albert S. Palatnick Aug. 1976 100 p
(Contract DOT-FA73WA-3169)
(AD-A037081; A414-F; FAA-RD-76-224) Avail: NTIS HC A05/MF A01 CSCL 17/7

The design, development, and field testing of a wide aperture digital VOR system are described. The VOR ground station is in the form of 8 crossed baseline pairs of interferometers, each pair energized successively by a set of pulses and phase shifts. The airborne receiver decodes the signals from each of the interferometers. This set of measurements on each axis permits complete resolution of ambiguities and the precise calculation of the angle with respect to the station. Field tests of the feasibility model indicate it is a high performance system capable of achieving an order of magnitude improvement in both site error reduction and in accuracy compared to present VOR systems. The measured accuracies were 0.11 deg standard deviation. Author

N77-24090# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
A REVIEW AND ANALYSIS OF THE MITRE BEACON COLLISION AVOIDANCE SYSTEM Final Report, Sep. 1975 - Sep. 1976
James J. Bagnall, Jr., Lawrence R. Dausin, Irvin W. Kay, and Arthur Krinitz Oct. 1976 209 p refs
(Contract DOT-FA74WA-3498)
(AD-A037225; IDA Study S-481; FAA-RD-77-2) Avail: NTIS HC A10/MF A01 CSCL 17/7

MCAS is an active collision avoidance system which makes use of air traffic control radar beacon system (ATCRBS) transponders already installed in many aircraft. However, because the system is active, its design assumes that airborne MCAS interrogator equipment will be limited to about ten percent of the flying population in order to avoid excessive garble for its own purposes and interference with regular ATCRBS ground stations MCAS uses the same threat logic for encounters between MCAS-equipped aircraft which was recommended by ANTC-117 and its performance suffers the same deficiencies resulting from the use of that logic as predicted in previous studies. These deficiencies are a high natural alarm rate due to a lack of certain parameter data, such as bearing rate and relative acceleration, and/or less than safe alarm criteria resulting from trade-offs intended to reduce the alarm rate. For encounters with ATCRBS transponder equipped aircraft, a special, so-called remitter logic which has similar deficiencies was developed. Author

N77-24091# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary, 1 Oct. - 31 Dec. 1976
1 Jan. 1977 50 p
(Contracts DOT-FA72WAI-261; F19628-76-C-0002)
(AD-A037130; FAA-RD-77-7) Avail: NTIS HC A03/MF A01 CSCL 17/7

Analytical studies, laboratory and flight experiments, and software developments supporting the concept feasibility and performance definition phase of the FAA discrete address beacon system program are reported. Author

N77-24092# Air Force Flight Test Center, Edwards AFB, Calif.
INERTIAL NAVIGATION SYSTEMS TESTING HANDBOOKS
Larry D. Plews, Charles W. Brinkley, and Kenneth E. Reeser Jul. 1976 185 p refs
(AD-A034921; AFFTC-TIH-76-1) Avail: NTIS HC A09/MF A01 CSCL 17/7

This handbook describes the methods being used in testing an inertial navigation system at the Air Force Flight Test Center (AFFTC). Future technological advances, deviations for peculiar characteristics of individual test programs, and cost constraints may necessitate other methods being used in some cases. A background on inertial navigation systems, flight testing, and documentation of computer software developed for post-flight reduction of data is presented. Author (GRA)

N77-24093# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
SRDS TECHNICAL PROGRAM DOCUMENT: FISCAL YEAR

1977 ENGINEERING AND DEVELOPMENT APPROVED PROGRAMS
Oct. 1976 149 p
(AD-A034195) Avail: NTIS HC A07/MF A01 CSCL 17/7

The report contains Research and Technology Resumes which reflect Systems Research and Development Service, Federal Aviation Administration, approved subprograms. These resumes identify the technical objective, approach, milestones scheduled for accomplishment, end-item products, FY-76 accomplishments, and source of requirements. GRA

N77-24094# Orincon Corp., La Jolla, Calif.
NAVSTAR/GPS NAVIGATION ANALYSIS AND ALGORITHM DEVELOPMENT STUDY Final Report
Charles A. Wolfe 30 Nov. 1976 209 p refs
(Contract N00123-76-C-0564)
(AD-A034873; OC-R-76-0564-1) Avail: NTIS HC A10/MF A01 CSCL 17/7

The ultimate objective of the study is to determine a set of algorithms which can be used in a NAVSTAR/GPS user navigation system. The criteria for the acceptability of the algorithm will be the accuracy of the position and velocity determination. Since there is no way of getting real data for algorithm verification at this time, it is imperative to establish system and error models. The results of analysis of proposed algorithms is then relative to the models used. An additional objective of the entire study is that it will be a design aid. Thus it is intended that through analysis of different receiver configurations, an analytic basis for certain design decisions can be established. The final computer program for analysis will not be an interactive computer aided design tool; however, it will provide for inclusion or exclusion of certain receiver options and variability of certain parameters in order to make the analysis useful for making design decisions. GRA

N77-24095# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COVARIANCE ANALYSIS OF KALMAN FILTERS PROPOSED FOR A RADIOMETRIC AREA CORRELATOR/INERTIAL NAVIGATION GUIDANCE SYSTEM M.S. Thesis
Charles Kenneth Fitschen Dec. 1976 156 p refs
(AD-A034278; GE/EE/76D-23) Avail: NTIS HC A08/MF A01 CSCL 17/7

In this report, a covariance analysis is performed on two Kalman filters proposed for use in a weapon system utilizing a strapdown inertial navigation system (INS), updated by position data from a radiometric area correlator (RAC), for guidance. Filter performance is analyzed when primary navigation information is provided by a Sperry INS, which uses laser gyroscopes, and when an INS employing conventional dry-tuned gyroscopes, manufactured by Hamilton-Standard, is incorporated into the weapon system. For the covariance analysis, truth models in the form of linear state equations are presented which reflect the best description of the weapon system when either the Sperry or Hamilton-Standard INS is used. The Sperry system model is composed of 46 states and the Hamilton-Standard system model 61 states. Primary emphasis in this investigation is placed on minimizing system terminal navigation error. GRA

N77-24096# Army Research Inst. for the Behavioral and Social Sciences, Arlington, Va.
SPECIALIZED TRAINING VERSUS EXPERIENCE IN HELICOPTER NAVIGATION AT EXTREMELY LOW ALTITUDES
John P. Farrell and Michael L. Fineberg Nov. 1976 12 p refs
(DA Proj. 2Q7-63743-A-772)
(AD-A034732; ARI-Tech-Paper-277) Avail: NTIS HC A01/MF 01 CSCL 01/2

An experiment was performed to determine if navigation skills acquired in general flight would transfer to flight at extremely low levels and if the transfer could be matched by specialized training. Since the effects of extensive experience were matched by only 15 hours of special training, transfer may not be as extensive as previously assumed. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N77-24097*# Sikorsky Aircraft, Stratford, Conn.
STUDY TO INVESTIGATE DESIGN, FABRICATION AND TEST OF LOW COST CONCEPTS FOR LARGE HYBRID COMPOSITE HELICOPTER FUSELAGE, PHASE 2
K. M. Adams and J. J. Lucas Apr. 1977 118 p refs
(Contract NAS1-13479)
(NASA-CR-145167) Avail: NTIS HC A06/MF A01 CSCL 01C

The development of a frame/stringer/skin fabrication technique for composite airframe construction was studied as a low cost approach to the manufacturer of larger helicopter airframe components. A center cabin aluminum airframe section of the Sikorsky CH-53D, was selected for evaluation as a composite structure. The design, as developed, is composed of a woven KEVLAR R-49/epoxy skin and graphite/epoxy frames and stringers. The single cure concept is made possible by the utilization of pre-molded foam cores, over which the graphite/epoxy pre-impregnated frame and stringer reinforcements are positioned. Bolted composite channel sections were selected as the optimum joint construction. The applicability of the single cure concept to larger realistic curved airframe sections, and the durability of the composite structure in a realistic spectrum fatigue environment, was described. Author

N77-24098*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THRUST AUGMENTOR APPLICATION FOR STOL AND V/STOL
Thomas N. Aiken Jun. 1977 10 p refs
(NASA-TM-X-73241; A-7020) Avail: NTIS HC A02/MF A01 CSCL 01C

A general parametric description is suggested for thrust augmentor application to STOL and V/STOL aircraft. The parameters and their relationships are discussed using several aircraft augmentor integration problems. For a STOL transport design, the ram drag is a key consideration, limiting the maximum gross augmentation that can be utilized. Maximizing gross augmentation and balancing the aircraft are key considerations for a V/STOL fighter design. Results from wind tunnel investigations on several different thrust augmentor concepts and system studies on STOL transport designs are also included. Author

N77-24099*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD FOR MEASURING AIRCRAFT HEIGHT AND VELOCITY USING DUAL TELEVISION CAMERAS
W. Robert Young 4 Jan. 1977 18 p
(NASA-TM-X-72829) Avail: NTIS HC A02/MF A01 CSCL 01C

A unique electronic optical technique, consisting of two closed circuit television cameras and timing electronics, was devised to measure an aircraft's horizontal velocity and height above ground without the need for airborne cooperative devices. The system is intended to be used where the aircraft has a predictable flight path and a height of less than 660 meters (2,000 feet) at or near the end of an air terminal runway, but is suitable for greater aircraft altitudes whenever the aircraft remains visible. Two television cameras, pointed at zenith, are placed in line with the expected path of travel of the aircraft. Velocity is determined by measuring the time it takes the aircraft to travel the measured distance between cameras. Height is determined by correlating this speed with the time required to cross the field of view of either camera. Preliminary tests with a breadboard version of the system and a small model aircraft indicate the technique is feasible. Author

N77-24100*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT-MEASURED LIFT AND DRAG CHARACTERISTICS OF A LARGE, FLEXIBLE, HIGH SUPERSONIC CRUISE AIRPLANE

Henry H. Arnaiz Washington May 1977 62 p refs
(NASA-TM-X-3532; H-913) Avail: NTIS HC A04/MF A01 CSCL 01C

Flight measurements of lift, drag, and angle of attack were obtained for the XB-70 airplane, a large, flexible, high supersonic cruise airplane. This airplane had a length of over 57 meters, a takeoff gross mass of over 226,800 kilograms, and a design cruise speed of Mach 3 at an altitude of 21,340 meters. The performance measurements were made at Mach numbers from 0.72 to 3.07 and altitudes from approximately 7620 meters to 21,340 meters. The measurements were made to provide data for evaluating the techniques presently being used to design and predict the performance of aircraft in this category. Such performance characteristics as drag polars, lift-curve slopes, and maximum lift-to-drag ratios were derived from the flight data. The base drag of the airplane, changes in airplane drag with changes in engine power setting at transonic speeds, and the magnitude of the drag components of the propulsion system are also discussed. Author

N77-24101# Georgia Inst. of Tech., Atlanta.
HELICOPTER HOVERING PERFORMANCE STUDIES. 1: VORTEX WAKE ANALYSIS. 2: TEST FACILITY. 3: BLADE TIP PRESSURE DISTRIBUTIONS Final Technical Report, 1 Sep. 1973 - 31 Oct. 1976
Robin B. Gray, Howard M. McMahon, George T. Bird, John G. Palfery, Satish S. Samant, and T. P. Shivananda Oct. 1976 82 p refs
(Grants DA-ARO(D)-31-124-73-G184; DAAG29-76-G-0007) (AD-A034093; ARO-11630.1-E) Avail: NTIS HC A05/MF A01 CSCL 01/3

Results are presented from studies of several problem areas which are related to helicopter hovering performance prediction. A working hypothesis is described for including the tip vortex core effect in a vortex wake analysis and it is shown that the tip vortex geometry in the near wake can be calculated with good accuracy for rotors having fewer than five blades. A hovering model rotor test facility of reduced size is described. Data from this facility include measured pressure distributions on the tip of a single-bladed rotor. Author (GRA)

N77-24102# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
AN EXPERIMENTAL INVESTIGATION OF FAVORABLE INTERFERENCE EFFECTS FROM A WING AND PROPROTOR M.S. Thesis
Steven Lyttle Griffith 1976 67 p refs
(Contract DAHC04-75-C-0023; Grant DAHC04-75-G-0007)
(AD-A034075) Avail: NTIS HC A04/MF A01 CSCL 01/3

Although research on V/STOL aircraft has been extensive, there are other covertiplane configurations yet to be studied. Previous investigations of tilting proprotor concepts have considered the overall aerodynamic characteristics of specific designs. It is the purpose of this research to experimentally investigate the lift and drag characteristics of a constant-pitch proprotor and wing interaction system in the North Carolina State University subsonic wind tunnel. The testing system consisted of five basic parts, the proprotor and wing models, the North Carolina State University subsonic wind tunnel, the strain gage balance system, the system instrumentation, and the proprotor alignment, drive and shaft assembly. GRA

N77-24103# Federal Aviation Administration, Washington, D. C.
REPORT TO CONGRESS BY THE FEDERAL AVIATION ADMINISTRATION ON THE ENERGY EFFICIENCY OF AGENCY REGULATIONS Final Report
Nov. 1976 133 p
(AD-A034611) Avail: NTIS HC A07/MF A01 CSCL 10/1

All regulations and laws administered by the FAA were examined for their effect on energy consumption. An inventory of regulations requiring activities which lead to fuel usage was prepared and organized. The following general groupings were identified: (1) flight test programs; (2) environmental control; (3) aircraft fuel supply; (4) aircraft speed and flight altitude; (5) airspace and air traffic control; (6) aircraft equipment; (7) crewmember qualifications. GRA

N77-24104# McDonnell Aircraft Co., St. Louis, Mo.
TURBINE ENGINE MULTI-MISSION PROPULSION SIMULATOR WIND TUNNEL DEMONSTRATION Final Report, Jul. 1973 - 30 Oct. 1976
M. F. Eigenmann, R. L. Bear, and T. C. Chandler Wright-Patterson AFB, Ohio AFAPL Nov. 1976 350 p refs
(Contract F33615-73-C-2051; AF Proj. 668A)
(AD-A034282; AFAPL-TR-76-73) Avail: NTIS HC A15/MF A01 CSCL 21/5

A turbine engine multi-mission propulsion simulator, developed by the Air Force Aero Propulsion Laboratory (AFAPL) to permit improved aircraft performance prediction capability through the simultaneous simulation of inlet/airframe/nozzle flowfields, was successfully demonstrated in a wind tunnel model tested in the Arnold Engineering Development Center 16 ft. Transonic Tunnel. The model tested is simple, featuring the forebody, inlet and nozzle of an advanced fighter aircraft, but no wings or tail surfaces. It is adaptable to three different test modes - simulator - equipped, conventional aero flow-through and conventional jet effects, and provides for the simultaneous measurement of the total airframe, aft-end and simulator forces and moments. Extensive pressure instrumentation is also provided on the fuselage for flowfield interaction studies. Wind tunnel test data was obtained from Mach 0.6 to 1.45, and at angles of attack from -1.6 to 16 degrees. The results of the test indicate that the propulsion simulator is a viable wind tunnel test tool that can be effectively operated under realistic test conditions. Comparison of the aerodynamic performance of this configuration, as obtained from both simulator and conventional test techniques, showed relatively small differences, thereby indicating small inlet/aft-end flowfield interactions for this inlet/nozzle spacing. Data repeatability obtained with the simulator model was comparable to that obtained on the conventional models. Author (GRA)

N77-24105# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SYSTEM SIMULATION IN AIRCRAFT LANDING GEAR AND TIRE DEVELOPMENT M.S. Thesis
John Anthony Skorupa Dec. 1976 140 p refs
(AD-A034942; GAE/MC/76D-7) Avail: NTIS HC A07/MF A01 CSCL 01/2

Main gear load vs. time is predicted for an F-4E aircraft through the use of subsystem modeling and analog computation. Subsystems modeled are the aerodynamics, engine dynamics, vertical strut dynamics, fore-aft strut dynamics, tire/wheel dynamics, brake dynamics, and antiskid dynamics. The problem is restricted to a landing sequence with three degrees of freedom permitted for the aircraft. Aerodynamics are based on constant coefficients of lift, drag, and pitching moment. A drag chute is also employed. Engine dynamics are based on a linear thrust vs. velocity schedule. The strut dynamics are modeled by a mass-spring-damper system. The tire/wheel dynamics subsystem applies Newton's Second Law to derive the wheel slip ratio and ground-tire coefficient of friction. Brake dynamics are based on a schedule of brake torque vs. brake pressure. Antiskid dynamics model the Hytrol Mark II antiskid system. Stopping distances from simulation are compared to flight test data to verify the model. Results from the simulation agree with flight test data. A schedule of main gear load vs. velocity is proposed as an alternative to current tire testing practice. Author (GRA)

N77-24106# Hughes Helicopters, Culver City, Calif.
DESIGN, FABRICATION, AND TESTING OF ADVANCED COMPOSITE AH-1G TAIL SECTION (TAIL BOOM/VERTICAL FIN) Final Report, Jul. 1973 - Feb. 1976
James F. Needham Nov. 1976 164 p refs Prepared in cooperation with Fiber Sci., Inc.
(Contract DAAJ02-73-C-0079; DA Proj. 1F2-63211-DB41)
(AD-A034457; HH-76-50; USAAMRDL-TR-76-2421) Avail: NTIS HC A08/MF A01 CSCL 01/3

The purpose of this program was to design and fabricate a primary structural component for a helicopter using advanced composite materials. The component selected was the tail boom and vertical fin of the AH-1G Cobra helicopter. The composite tail boom was required to meet the existing metal tail boom structural design and stiffness criteria, and to be interchangeable with the metal tail boom. Design objectives were to reduce the life cycle costs, to minimize the parts count, and to lower the

overall weight of the existing structure. The composite tail boom successfully met the design criteria and objectives and completed all the structural and flight tests. The composite tail boom structure is a semimonocoque configuration using a sandwich wall construction. The inner and outer skins are fabricated of Thornel 300 graphite filaments with an epoxy resin, and the sandwich core is Nomex honeycomb. The wet-filament-winding technique was used in the fabrication of the major components. This research and development program established that primary helicopter components could be efficiently fabricated from composite materials. The resulting structure would have a higher fatigue strength and a lower life-cycle cost than the metal structure, and it would have an improved ballistic tolerance. Author (GRA)

N77-24107# Advisory Group for Aerospace Research and Development, Paris (France).
FLIGHT TEST TECHNIQUES
Apr. 1977 415 p In ENGLISH; partly in FRENCH Conf. Proc. of the Flight Mechanics Panel Symp., Porz Wahn, W. Germany, 11-14 Oct. 1976
(AGARD-CP-223; ISBN-92-835-0194-2) Avail: NTIS HC A18/MF A01

Techniques used in flight clearance of the basic air vehicles, including flight control systems, engines, engine-inlet systems, etc., and the externally carried weapons are described along with techniques used in weapon system development. Instrumentation systems and components, data transmission, data processing, airborne displays and computers, and real time flight test analysis and monitoring are among the topics discussed. For individual titles, see N77-24108 through N77-24132.

N77-24108# Air Force Flight Test Center, Edwards AFB, Calif.
FLIGHT CONTROL SYSTEM STRUCTURAL RESONANCE AND LIMIT CYCLE RESULTS
Paul W. Kirsten *In* AGARD Flight Test Tech. Apr. 1977 17 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Theory, testing, and results pertaining to limit cycle and structural resonance characteristics of aircraft flight control are presented. Methods for insuring that limit cycling and structural resonance do not occur unexpectedly during flight are suggested. Ground tests and inflight envelope expansion tests were used with success in the past to determine limit cycle and structural resonance characteristics. Data obtained from these tests are presented for several aircraft. Also, control system modifications made on several aircraft to eliminate control system instabilities which were uncovered through ground testing are included. Additional topics are discussed which include digital sampling effects on limit cycle characteristics, large amplitude saturation limit cycles, and pilot-in-the-loop instabilities. Author

N77-24109# Hawker Siddeley Aviation Ltd., Dunsfold (England).
FLIGHT TESTING TECHNIQUES, AUTUMN 1976
R. J. Poole *In* AGARD Flight Test Tech. Apr. 1977 17 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

A test program to demonstrate the aircraft's controllability in, and the recovery procedure from a spin formulated with reference to spinning tunnel tests is described. Data presented are gathered using the aircraft's PCM recording equipment and telemetered records observed by flight test engineers, together with the safety ground pilot, while the spins were being executed. This instrumentation together with the pilot displays and warnings in the cockpit are described. The recovery procedures to be adopted and the pilots' qualitative assessment of their effectiveness are included. Author

N77-24110# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
METHODS AND TECHNIQUES OF GROUND VIBRATION TESTING
Gerard Piazzoli *In* AGARD Flight Test Tech. Apr. 1977 9 p refs In FRENCH; ENGLISH summary (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Flight vibration tests, an important and sophisticated part of the aeroelastic research carried out for prototype clearance and certification of production aircraft, are described along with methods used for dynamic investigations of structural stability. The different techniques for delivering excitation forces, the special equipment of measurement and conditioning, and present methods of data processing and analysis are illustrated. Typical installations on aircraft of various types are described. Author

N77-24111# British Aircraft Corp., Preston (England). Military Aircraft Div.
TORNADO FLIGHT LOADS SURVEY
D. W. Altham, D. K. Potter, J. Nuscheler (Messerschmitt-Boelkow-Blohm GmbH, Munich), and W. Seidel (Messerschmitt-Boelkow-Blohm GmbH, Munich) *In* AGARD Flight Test Tech. Apr. 1977 16 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Flight loads survey instrumentation and its calibration, date acquisition and analysis techniques, and a flight test program for the TORNADO aircraft are described. Several examples of test results are given and discussed. Author

N77-24112# British Aircraft Corp., Preston (England). Military Aircraft Div.
THE EFFECT OF A COMMAND AND STABILITY AUGMENTATION SYSTEM ON FLIGHT TESTING
T. B. Saunders *In* AGARD Flight Test Tech. Apr. 1977 16 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The influence of a CSAS on flight test procedures, analysis techniques, and instrumentation requirements is discussed and is shown to be a significant factor in promoting developments in these three areas. Current handling qualities criteria are considered in relation to the CSAS. Some handling qualities requirements are written in terms that cover the introduction of major new concepts like the CSAS. Author

N77-24113# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
DEVELOPMENT FLIGHT TEST TECHNIQUES FOR DIGITAL MULTIMODE FLIGHT CONTROL SYSTEMS
David L. Carleton *In* AGARD Flight Test Tech. Apr. 1977 14 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

A technique that assesses the aircrafts' ability to allow the pilot to perform precision tracking tasks, such as air to air gunnery and air to ground weapon delivery is described. Data requirements, evaluation criteria, and examples of how the technique is used in flight test programs are included along with a discussion of merits and limitations of the technique. Author

N77-24114# British Aircraft Corp. (Operating) Ltd., Bristol (England). Commercial Aircraft Div.
FLIGHT ASSESSMENT AND DEVELOPMENT OF THE CONCORDE INTAKE SYSTEM
D. P. Morriss *In* AGARD Flight Test Tech. Apr. 1977 42 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The rapid exposure and resolution of problems were the prime objectives of the flight investigation program, devised to exploit fully the advantage of preflight prediction of potential problem areas. An account of the flight investigation, including a description of the test techniques employed, is placed in perspective by a brief recapitulation of the design of the engine air inlet system and the associated fundamental control concepts. The impact of flight investigation on the evolution of the certification standard aircraft is apparent, e.g. modification of the prototype standard wing leading edge to improve surge free negative incremental normal acceleration capability, and suppression of local reference pressure sensing for automatic air inlet control in favor of computed reference signals derived from central air data sources. In similar contex the clear emergence of the necessity to place reliance on flight test data as the basis of formulation of the production standard air inlet control system functional laws, is of paramount significance. Flight determination of the sensitivity of engine surge thresholds and hence the effective maneuver, Mach Number, and throttling limits, to systematic variation of inlet geometry proved to be essential. The delicate balance between the requirements of performance, inlet/engine compatibility, and simplicity of crew management, dictated by

considerations of commercial viability, was achieved by the air inlet control system laws so derived. Author

N77-24115# Royal Aircraft Establishment, Farnborough (England).
WEAPONS TESTING TECHNIQUES
F. J. Bigg, N. Tait (Cape Engineering Ltd., Warwick, Eng.), and D. A. Williams (Cranfield Inst. of Technology) *In* AGARD Flight Test Tech. Apr. 1977 13 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The philosophy adopted by the Directorate of Air Armament MOD (PE) United Kingdom and the Air Armaments Department, Royal Aircraft Establishment, Farnborough in obtaining experimental information relevant to the design and clearance of free fall weapons and associated carriage equipment is described. A number of instrumented stores which were developed as a result are described in some detail, and the conclusions are presented. Author

N77-24116# National Gas Turbine Establishment, Pyestock (England).
SUPERSONIC POWERPLANT TESTING FOR PREFLIGHT PERFORMANCE EVALUATION
G. G. Annear *In* AGARD Flight Test Tech. Apr. 1977 12 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The facilities used to evaluate the performance at supersonic speeds of complete propulsion units, (inlet, engine and exhaust system) is described. The way in which ground level test bed data are used to predict flight performance, and how the prediction may be refined by the use of altitude Cell data are discussed. Author

N77-24117# National Gas Turbine Establishment, Pyestock (England).
PROCEDURES FOR THE MEASUREMENT OF ENGINE THRUST IN FLIGHT
J. C. Ascough *In* AGARD Flight Test Tech. Apr. 1977 19 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

General principles of thrust and drag accounting are discussed, the essential fluid flow relationships on which measurements are based are presented, and the necessary testing of model components and full scale engine is indicated. A strong emphasis in placed upon error estimation and thrust option management. Author

N77-24118# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
ESTIMATION OF DRAG AND THRUST OF JET-PROPELLED AIRCRAFT BY NON-STEADY FLIGHT TEST MANEUVERS
J. A. Mulder and J. M. VanSliedregt *In* AGARD Flight Test Tech. Apr. 1977 30 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

When measuring aircraft performance or lift-drag characteristics in steady or nonsteady flight numerical apriori information is required from engine (altitude) test facilities for an accurate determination of engine thrust. It is shown that this need for apriori information may be eliminated by an inflight calibration of the measuring probes for engines gross thrust and mass flow simultaneously with the measurement of the aircraft lift-drag characteristics. Results are presented of 9 nonsteady flight test maneuvers with a Hawker Hunter mk VII jet aircraft at 10.000, 20.000, and 30.000 ft nominal flight altitude. Besides lift-drag characteristics and engine gross thrust and mass flow calibration factors, several alternative performance characteristics as excess thrust in horizontal flight and also stability and control characteristics may be deduced from the measurements. The validity of the flight test results, in particular with respect to the inflight calibration of the gross thrust and mass flow measuring probes is, because of the particular aircraft exploited for the flight tests, restricted to the case of a socalled straight jet engine configuration and a non-flexible aircraft. Author

N77-24119# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
FLIGHT TESTING AND EVALUATION TECHNIQUES FOR THE DETERMINATION OF HANDLING QUALITIES
Horst Wuennenberg and Ulrich VonMeier *In* AGARD Flight Test Tech. Apr. 1977 13 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The techniques of handling qualities determination in flight testing are discussed. The main targets for flight testing are described and examples from the Alpha Jet flight testing are presented. It is proposed to present the necessary information for flight manual and certification documentation (pilot comments, flight test evaluation, and theoretical calculations) in table form. Author

N77-24120# Air Force Flight Test Center, Edwards AFB, Calif.
A MISSION ORIENTED FLIGHT TEST TECHNIQUE FOR IDENTIFYING AIRCRAFT AND FLIGHT CONTROL SYSTEM TRANSFER FUNCTIONS
Thomas R. Twisdale, Gerald L. Jones, and Tice A. Ashurst *In* AGARD Flight Test Tech. Apr. 1977 14 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Data analysis techniques were developed at the Air Force Flight Test Center (AFFTC) which offer unique and quantitative insights into pilot-in-the-loop handling qualities. These data analysis techniques, called System Identification From Tracking (SIFT), are based on time series analysis procedures. These procedures are used to perform a frequency domain evaluation of data obtained during closed-loop, mission oriented precision tracking maneuvers. Normal stability and control test parameters are measured and recorded in the time domain during the maneuver. As many as four of these parameters are selected as multiple inputs to the system being evaluated and one parameter is selected as the system response. These time domain data are Fourier transformed into the frequency domain, where spectral content, multiple frequency response transfer functions, and coherence functions are estimated and plotted. Depending on the parameters selected for analysis, either the flight control system (or its components), or the airframe aerodynamics, or the total system characteristics (control system plus aerodynamics) may be identified. Interim results show that, for the aircraft being analyzed, lateral-directional coupling into the pitch axis has an unexpected and apparently significant impact on longitudinal handling qualities, even for small angles of attack and sideslip. Author

N77-24121# Air Force Flight Test Center, Edwards AFB, Calif. Systems Engineering Branch.
OVERALL AIRCRAFT SYSTEMS EVALUATION
Frank N. Lucero and Charles E. Adolph *In* AGARD Flight Test Tech. Apr. 1977 13 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The managerial and test procedures used by personnel at the Air Force Flight Test Center to plan, conduct, and report on overall aircraft systems test programs are described. Author

N77-24122# National Aerospace Lab., Amsterdam (Netherlands).
DETERMINATION OF ANTENNA RADIATION PATTERNS, RADAR CROSS SECTIONS AND JAM-TO-SIGNAL RATIOS BY FLIGHT TESTS
O. B. M. Pietersen, G. J. Alders, and R. B. A. Wasch *In* AGARD Flight Test Tech. Apr. 1977 6 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

A data acquisition and processing method, aimed at the determination of radiation patterns of airborne equipment is described. The data acquisition procedure and, more specific, the data processing and presentation schemes used are emphasized. Author

N77-24123# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. Fuer Flugfuehrung.
REAL TIME DATA TRANSMISSION AND PROCESSING FOR THE DETERMINATION OF AIRCRAFT ANTENNA RADIATION PATTERNS
Helmut Bothe *In* AGARD Flight Test Tech. Apr. 1977 11 p

refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

A measuring system determining aircraft antenna radiation patterns in flight is described. Measuring system requirements and configuration are outlined. Real time data processing and quick-look monitoring during flight tests are enabled by a telemetry system, the state of which is described. Author

N77-24124# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
HYBRID REFERENCE SYSTEMS FOR FLIGHT TESTING
Heinz Winter and Ulrich Brokof *In* AGARD Flight Test Tech. Apr. 1977 15 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Hybrid reference systems consisting of ground-based measuring equipment (tracking radar, long sitance radar) and on-board sensors (Doppler or inertial navigation systems) were analyzed with respect to the accuracy of position, velocity, and attitude measurement. Flight experiments demonstrated that the high accuracies required for weapon guidance systems testing can be obtained with such systems. Author

N77-24125# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
FLIGHT TESTING OF DISPLAYS IN A HELICOPTER
R. Beyer *In* AGARD Flight Test Tech. Apr. 1977 11 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Electro-optical sensors and electronic displays for a future helicopter avionics system may extend the flexibility of helicopter operation at night and in bad weather. Flight tests were made with a simulated system which presented a combination of flight instruments and an image of the terrain to the pilot. Means were developed to assess flight performance and pilot strain in flights with the system and some of the measures and the results obtained are discussed. Author

N77-24126# Royal Aircraft Establishment, Farnborough (England). Dept. of Instrumentation and Trials.
ANGULAR MOTION SENSING WITH GAS ROTORS
W. R. MacDonald *In* AGARD Flight Test Tech. Apr. 1977 26 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Angular motion transducers based on a gas rotor are discussed. These exploit the fact that when a coil of tube containing gas experiences angular acceleration, a pressure proportional to the acceleration is generated. The pressure is measured by a capacitive membrane sensor and depending on the design characteristics, outputs representing angular acceleration, vibratory angular displacement, or vibratory angular velocity may be obtained. The design and performance of these three types of transducer are discussed in detail and examples of practical instruments are given. Gas rotor transducers display characteristics similar to those of rotary spring-mass systems, but they are effectively devoid of moving parts and in principle are perfectly balanced. They are therefore potentially cheap and very robust. Moreover, since the rotor can be of any convenient shape, optimum use can be made of available space and multi-axis instruments of similar size to their single-axis counterparts are feasible.
Author

N77-24127# Centre d'Essais en Vol, Istres (France).
EXAMPLES OF LASER UTILIZATION IN CIVIL AIRCRAFT CERTIFICATION TESTS
Nicolas Lapchine *In* AGARD Flight Test Tech. Apr. 1977 20 p refs In FRENCH (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The STRADA system installed at the Brittany Flight Test Center was used in flight certification tests of the Concorde and Mercure 100 aircraft. The system uses optical radar (LIDAR) mounted on a turret, consisting of a yttrium-aluminum yag laser transmitting in the infrared at a frequency of 3200 impulses per second. The luminous energy received by passive retroreflectors mounted on the aircraft is received in an optical reception system linked to two receivers which measure distance and angle variations. A computer is used for real time calculation of the trajectory of the reflectors mounted on the aircraft. Tests for both the Concorde and the Mercure flights are described.
Transl. by A.R.H.

N77-24128*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TELEMETRY AND DATA RELAY FOR MANNED SPACE PROGRAMS
Kim W. Anson *In* AGARD Flight Test Tech. Apr. 1977 14 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Previously and currently planned methods of transferring or relaying telemetered information from a remote receiving station to the Mission Control Center, at the National Aeronautics and Space Administration Lyndon B. Johnson Space Center, are discussed. The data flow techniques of the Apollo Program (fixed formats), the Skylab Program (data compression), and the Space Shuttle Program (data throughput) are defined and analyzed according to their advantages and deficiencies from an operations viewpoint. Excluded from the data flow technique discussions are command data, tracking data, television data, and Teletype and Datafax messages. Voice transmissions are addressed in the Space Shuttle Program discussion because they form a part of the telemetry data stream. The tradeoffs between actual data flow requirements and existing communications limitations are addressed for each of these programs. Finally, a short discussion of current problem areas in the planned ground data transmission system for the Space Shuttle Program is presented. Author

N77-24129# Boeing Aerospace Co., Seattle, Wash.
RESORS: A SYSTEM FOR ON-LINE, ON-BOARD DATA REDUCTION AND PERFORMANCE ANALYSIS DEVELOPED ESPECIALLY FOR E-3A FLIGHT TESTS
H. A. Williams *In* AGARD Flight Test Tech. Apr. 1977 13 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

A system of computer programs (RESORS) to analyze radar report data using an interactive graphics terminal is described. Developed for E-3A test flights, RESORS permits on-board, on-line engineering judgemental decisions in data reduction and analysis. With RESORS, complex multi-dimensioned data can be displayed and sorted in any pair of twenty or so dimensions assisting in immediate decisions affecting test conduct and control. Primary functions include a quick look at flight results, isolation of identifiable radar reports such as tracks, detection of radar anomalies, and determination of false alarm rates. The program flexibility provides both detailed analysis capability, and a big picture overview of flight test data. Author

N77-24130*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AN ADVANCED AIRBORNE DATA ACQUISITION SYSTEM
Febo Bartoli *In* AGARD Flight Test Tech. Apr. 1977 12 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The development and features of and user experience with an advanced airborne data acquisition system are described. The system consists of as many as 16 high speed pulse code modulation data acquisition units which are integrated with an airborne computer and a cockpit display unit. The data acquisition units may be operated without the computer. Operation without the computer is termed stand-alone operation. Computer integrated operation is intended for large-scale projects, and stand-alone operation is designed for small-scale projects. The cockpit display unit, which is part of the computer operated system, displays computed real time data in engineering units. An example of the cost reduction experienced by a major aircraft company by using the advanced data acquisition system is given. Author

N77-24131# Boeing Commercial Airplane Co., Seattle, Wash.
USE OF ONBOARD REAL-TIME FLIGHT TEST ANALYSIS AND MONITOR SYSTEMS Progress Report
William S. Lieberman *In* AGARD Flight Test Tech. Apr. 1977 10 p (For primary document see N77-24107 15-05)

Avail: NTIS HC A18/MF A01

The actual usage of onboard real time computer controlled data analysis systems during the recent flight test programs for two different Boeing model aircraft, and the plans for use in future application are described. The results of such usage have been the shortening in schedule flow time and cost of the programs, as well as the increased accuracy of results and reduction in post-flight batch data processing. They have also reduced the dependency on geographical location of the test area since down link telemetry systems are not required. Author

N77-24132# Air Force Flight Test Center, Edwards AFB, Calif.
THE AUTOMATED FLIGHT TEST DATA SYSTEM
Charles O. Johnson and Paul J. Sehnert *In* AGARD Flight Test Tech. Apr. 1977 17 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The United States Air Force, Air Force Flight Test Center Automated Flight Test Data System (AFTDS), a derivative of the Grumman real time system, was extensively used by the B-1 development test program, was used to a lesser degree for the F-5E spin evaluation, and has considerable use planned during the F-16 full scale development tests. The applications range from simple real time validation of instrumentation system health to presentation of engineering data such as drag polars, load analysis, and terrain following/terrain avoidance system information. A system that employs on-line computation to generate real time engineering data is also described. Interfaces with the onboard instrumentation system, the planning activity required to effectively apply this data system, description and presentation of typical data analyses packages, consideration of the limitations, benefits, and indication of future plans are covered in greater detail. Author

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-24133*# Systems Control, Inc., Palo Alto, Calif.
CIVIL MINI-RPA'S FOR THE 1980'S: AVIONICS DESIGN CONSIDERATIONS Final Report, Jan. - Jun. 1975
J. S. Karmarkar Jul. 1975 63 p refs
(Contract NAS2-7747)
(NASA-CR-127679) Avail: NTIS HC A04/MF A01 CSCL 01D

A number of remote sensing or surveillance tasks (e.g., fire fighting, crop monitoring) in the civilian sector of our society may be performed in a cost effective manner by use of small remotely piloted aircraft (RPA). This study was conducted to determine equipment (and the associated technology) that is available, and that could be applied to the mini-RPA and to examine the potential applications of the mini-RPA with special emphasis on the wild fire surveillance mission. The operational considerations of using the mini-RPA as affected by government regulatory agencies were investigated. These led to equipment requirements (e.g., infra-red sensors) over and above those for the performance of the mission. A computer technology survey and forecast was performed. Key subsystems were identified, and a distributed microcomputer configuration, that was functionally modular, was recommended. Areas for further NASA research and development activity were also identified. Author

N77-24134# Illinois Univ., Urbana-Champaign. Savoy Aviation Research Lab.
ADVANCED INTEGRATED AIRCRAFT DISPLAYS AND AUGMENTED FLIGHT CONTROL Final Scientific Report, 1973 - 1976
Stanley N. Roscoe Nov. 1976 42 p refs
(Contract N00014-76-C-0081)
(AD-A034817; ARL-76-17/ONR-76-4) Avail: NTIS HC A03/MF A01 CSCL 01/4

The Aviation Research Laboratory of the University of Illinois has investigated integrated computer-generated symbolic displays and computer-augmented flight control for the Office of Naval Research. The research was directed toward (1) the isolation of minimum sets of visual image cues sufficient for spatial and geographic orientation in the various ground-referenced phases of representative flight missions, (2) the generation and spatially integrated presentation of computed guidance commands and fast-time flight path predictors, and (3) the matching of the dynamic temporal relationships among these display indications for compatibility with computer-augmented flight performance control dynamics, both within each ground-referenced mission phase and during transitions between phases. The investigative program drew selectively upon past work done principally under ONR sponsorship or partial sponsorship, including the ANIP and JANAIR programs. Author (GRA)

N77-24135# Army Electronics Command, Fort Monmouth, N.J.
DIGITAL GENERATION OF CONTOUR MAPS FOR RASTER SCAN DISPLAY
Victor Vajo Dec. 1976 57 p
(DA Proj. 1F2-62202-AH-85)
(AD-A034663; ECOM-4454) Avail: NTIS CSCL 17/7

This report is concerned with the development of a digitally generated contour map to be displayed on standard raster TV for use in Army aircraft. The requirement for a display of this type is generated by the operations of Army aircraft in nap-of-the-earth (NOE) flight during both day and night operation. NOE flight in this case refers specifically to pilotage at or below tree top level. The study proved the feasibility of generating digital contour maps for display on standard TV monitors. Computer programs were written in assembly language for the Singer SKC-2000 Airborne Computer which generate two color (black and white) contour maps for display on a standard 525 line television system. GRA

N77-24136# Air Force Academy, Colo.
HELMET MOUNTED DISPLAYS AS AN ALTERNATE SOURCE OF FLIGHT INFORMATION Final Report
Eugene H. Galluscio, John E. Rasinski, and Robert G. Eggleston Jan. 1977 32 p refs
(AD-A034724; USAFA-TR-77-1) Avail: NTIS HC A03/MF A01 CSCL 01/2

The potential use of Helmet Mounted Displays (HMD) as an alternate source of flight information was examined. Air Force T-41 instructor pilots were trained to perform two complex flight maneuvers in a GAT 1 flight simulator using a monocular visor-projected display as the sole source of aircraft flight information. A search pattern and weapons delivery maneuver were flown utilizing standard aircraft instruments. The pilot flew the maneuvers under four experimental conditions: (1) referencing the simulator instruments only, (2) referencing the simulator instruments with selected instruments occluded, (3) referencing the helmet display only, (4) referencing the helmet display with selected instruments occluded. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-24137*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTERIOR AND EXTERIOR FUSELAGE NOISE MEASURED ON NASA'S C-8A AUGMENTOR WING JET-STOL RESEARCH AIRCRAFT
Michael D. Shovlin Apr. 1977 50 p refs
(NASA-TM-X-73235; A-7012) Avail: NTIS HC A03/MF A01 CSCL 20A

Interior and exterior fuselage noise levels were measured on NASA's C-8A Augmentor Wing Jet-STOL Research Aircraft

in order to provide design information for the Quiet Short-Haul Research Aircraft (QSRA), which will use a modified C-8A fuselage. The noise field was mapped by 11 microphones located internally and externally in three areas: mid-fuselage, aft fuselage, and on the flight deck. Noise levels were recorded at four power settings varying from takeoff to flight idle and were plotted in one-third octave band spectra. The overall sound pressure levels of the external noise field were compared to previous tests and found to correlate well with engine primary thrust levels. Fuselage values were 145 + or - 3 dB over the aircraft's normal STOL operating range. Author

N77-24138*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INLET REYNOLDS NUMBER AND TEMPERATURE EFFECTS ON THE STEADY-STATE PERFORMANCE OF A TFE731-2 TURBOFAN ENGINE

George A. Bobula and Roy A. Lottig Washington May 1977 51 p refs Prepared in cooperation with the US Army Air Mobility R and D Lab., Cleveland

(NASA-TM-X-3537; E-8941) Avail: NTIS HC A04/MF A01 CSCL 21E

Effects of varying engine inlet Reynolds number index (0.75, 0.50, 0.25, and 0.12) and temperature (289 and 244 K) on a TFE731-2 turbofan engine were evaluated. Results were classified as either compression system effects or effects on overall performance. Standard performance maps are used to present compression system performance. Overall performance parameters are presented as a function of low rotor speed corrected to engine inlet temperature. Author

N77-24139*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYTICAL PREDICTION OF THE PERFORMANCE AND STABILITY OF A J85-13 COMPRESSOR WITH DISTORTED INLET FLOW

Edward J. Milner Washington May 1977 31 p refs

(NASA-TM-X-3515; E-8887) Avail: NTIS HC A03/MF A01 CSCL 21E

The parallel compressor concept was studied using a compressor model based on the overall clean-inlet performance map obtained from experimental tests in an altitude chamber using a General Electric J85-13 turbojet engine. The model, which includes a static-pressure balance calculation at compressor discharge, was exercised at conditions corresponding to 10 different screen-induced distortion patterns included in the experimental data base. The spoiled area of these patterns ranged from 30 deg to 180 deg, and the distortion screen density, or the area blocked by the screen wire per unit area of screen, varied from 26 to 69 percent. The study indicates that at the higher corrected speeds, the analytical surge lines obtained are good representations of the correspondending experimental surge lines and are independent of distortion angle or distortion angle or distortion level. Author

N77-24140*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF HIGH-AREA-RATIO ANNULAR DUMP DIFFUSER USING SUCTION-STABILIZED-VORTEX FLOW CONTROL

Albert J. Juhasz and John M. Smith Washington May 1977 41 p refs

(NASA-TM-X-3535; E-9011) Avail: NTIS HC A03/MF A01 CSCL 21E

A short annular dump diffuser having a geometry conductive to formation of suction stabilized toroidal vortices in the region of abrupt area change was tested. The overall diffuser area ratio was 4.0 and the length to inlet height ratio was 2.0. Performance data were obtained at near ambient temperature and pressure for inlet Mach numbers of 0.18 and 0.30 with suction rates ranging from 0 to 18 percent of total inlet mass flowrate. Results show that the exit velocity profile could be readily biased toward either wall by adjustment of inner and outer wall suction rates. Symmetric exit velocity profiles were inherently unstable with a tendency to revert to a hub or tip bias. Diffuser effectiveness was increased from about 38 percent without suction to over 85 percent at a total suction rate of 10 to 12 percent. At the same time diffuser total pressure loss was reduced from 3.1 percent to 1.1 percent at an inlet Mach number of 0.3. Author

N77-24141*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NOISE OF FAN DESIGNED TO REDUCE STATOR LIFT FLUCTUATIONS

James H. Dittmar, Richard P. Woodward, and Edward G. Stakolich Washington May 1977 47 p refs

(NASA-TM-X-3538; E-8986) Avail: NTIS HC A03/MF A01 CSCL 20A

An existing fan stage was redesigned to reduce stator lift fluctuations and was acoustically tested at three nozzle sizes for reduced noise generation. The lift fluctuations on the stator were reduced by increasing the stator cord, adjusting incidence angles, and adjusting the rotor velocity diagrams. Broadband noise levels were signficantly reduced in the middle to high frequencies. Blade passage tone sound power was not lessened, but decreases in the harmonics were observed. Aerodynamic improvements in both performance and efficiency were obtained. Author

N77-24142# European Space Agency, Paris (France).

INFLUENCE OF LEADING EDGE RADIUS ON THE PERFORMANCE OF HIGHLY DEFLECTED STATOR CASCADES

J. Paulon Mar. 1977 22 p refs Transl. into ENGLISH from Assoc. Tech. Maritime et Aeron., Bull. no. 73, 1973 p 485-503 Original report in FRENCH previously announced as 74A19686

(ESA-TT-362; ONERA-TP-1237) Avail: NTIS HC A02/MF A01

An experimental facility, which includes an inducer producing swirl in the flow in an annular channel between two coaxial cylinders, was used to study axial compressor stator blade profiles. These form a fixed annular cascade and the performances in compression, deflection, and efficiency are measured at the mid-radius. This facility is very flexible in operation since, by varying the supply total pressure, it allows a wide range of Mach numbers to be investigated between 0.30 and 0.80 (0.80 corresponds closely to the choking of the cascade studied). Furthermore, the angle of attack, and hence the incidence, can be varied over a range of about 12 deg by changing the inducer (5 inducers are used). The performances obtained with this cascade show that off-design losses are governed by the leading-edge radius which is thus seen to be an important parameter. Tests performed with the same blades, given a progressively rounded leading edge, show that although the performances in compression ratio and total pressure recovery remain practically unaffected near the design condition, a small leading-edge radius improves the deflection performance. A simple empirical formula correlating the experimental results is given which allows a grouped arrangement of the losses obtained. This might be useful in research to find an optimum stator as a function of the Mach number and the incidence. Author (ESA)

N77-24143# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

F100 MULTIVARIBLE CONTROL SYSTEM ENGINE MODELS/DESIGN CRITERIA Final Report, 1 Jun. 1975 - 31 Aug. 1976

Ronald J. Miller and Ronald D. Hackney Nov. 1976 135 p refs

(Contract F33615-75-C-2048; AF Proj. 3066)

(AD-A033532; FR-7809; AFAPL-TR-76-74) Avail: NTIS HC A07/MF A01 CSCL 21/5

The objective of the F100 multivariable Control research program is to extend the linear quadratic regulator (LQR) theory to develop a 'practical' control system that can operate a state-of-the-art gas turbine engine over its entire flight envelope. The engine selected for this program is a Pratt and Whitney Aircraft F100 afterburning turbofan. To determine the adequacy of the control synthesis effort, the resulting control logic will be incorporated into a digital computer/controller, which then will be used to control a F100 engine in an altitude test facility at NASA Lewis Research Center. The F100 engine computer simulations, the control criteria for defining the basic requirements of a F100 control system, and a brief evaluation of the resulting LQR engine control system are presented in this report. GRA

N77-24144# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
WATER INGESTION INTO AXIAL FLOW COMPRESSORS Final Report, 1 Apr. 1975 - 31 Aug. 1976
S. N. Murthy, B. A. Reese, C. L. Abernathy, and G. T. Arcangeli Wright-Patterson AFB, Ohio AFAPL Aug. 1976 128 p refs (Contract F33615-74-C-2014)
(AD-A033611; M-WPAFB-T-76-1; AFAPL-TR-76-77) Avail: NTIS HC A07/MF A01 CSCL 21/5

The problem of the flow of a gas-liquid mixture through a multi-stage axial compressor orginially designed for air flow arises during take-off from a rough runway with water on it and during rain. Preliminary investigations have revealed the problem areas in the fan, L.P., and H.P. compressor stages. The basic aerothermodynamic equations have been deduced in a form suitable for considering development of a computational program.
Author (GRA)

N77-24145# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF AN AIRJET DISTORTION GENERATOR USED TO PRODUCE STEADY-STATE, TOTAL-PRESSURE DISTORTION AT THE INLET OF TURBINE ENGINES Final Report, 16 Oct. 1975 - 4 Feb. 1976
B. W. Overall AEDC Dec. 1976 82 p refs Sponsored by Air Force
(AD-A033883; ARO-ETF-TR-76-91; AEDC-TR-76-141) Avail: NTIS HC A05/MF A01 CSCL 21/5

A performance evaluation of an airjet distortion generator system used to produce steady-state, total-pressure distortion at the inlet to a turbine engine was conducted. The capability of the system to duplicate screen-generated, parametric distortion patterns (180 deg, one per revolution; tip radial; hub radial) and to maintain a constant composite distortion pattern over a range of airflows is presented. A comparison of the effect of inlet distortion produced by screens to that produced by the airjet distortion generator system on the stability characteristics of a present-day turbofan engine is described. Author (GRA)

N77-24146# Defense Systems Management School, Fort Belvoir, Va.
IMPROVING JET ENGINE RELIABILITY AND MAINTAINABILITY: A CONCEPTUAL APPROACH
John D. Masson 5 May 1976 47 p refs
(DSMS Proj. PMC-76-1)
(AD-A033815) Avail: NTIS HC A03/MF A01 CSCL 21/5

The purpose of this report is to propose a management approach to be used to improve jet engine reliability and maintainability. The need for improvement is established through an examination of the life cycle of an engine, the estimated costs, costs associated with each life cycle phase, and the factors occurring during each phase that significantly affect reliability and maintainability. This review concludes that significant changes to the engine development and acquisition changes are not practical. The proposed approach is intended for use within the existing engine life cycle framework. GRA

N77-24147# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
INTERNAL AERODYNAMICS, HEAT TRANSFER AND HIGH TEMPERATURE MATERIALS IN AIR-BREATHING ENGINES Final Report, 20 Sep. 1968 - 30 Jun. 1976
W. Tabakoff Oct. 1976 74 p
(Contract DAAG29-69-C-0016)
(AD-A033668; Rept-76-50; ARO-T-4.78-E) Avail: NTIS HC A03/MF A01 CSCL 21/5

The research presented is concerned with improving the performance of air-breathing propulsion systems. Theoretical and experimental studies of basic phenomena upon which the performance is dependent, were carried out. These studies covered the following areas: (1) particulate flows in propulsion systems; (2) cascade aerodynamics; (3) jet mixing flow; (4) high temperature materials; and (5) gas turbine blades and combustion chambers heat transfer. Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-24148# European Space Agency, Paris (France).
STABILIZATION, GUST ALLEVIATION AND ELASTIC MODE CONTROL FOR AN AIRCRAFT MODEL MOVING IN THE WIND TUNNEL
Gernot Hoffmann Apr. 1977 150 p refs Transl. into ENGLISH of 'Stabilisierung, Boenkompensation u. Schwingungsdaempfung am elastischen, beweglichen Flugzeugmodell im Windkanal', DFVLR, Brunswick Report DLR-FB-76-44, DFVLR, Brunswick Report DLR-FB-76-44, 11 Aug. 1976 Original report in GERMAN previously announced as N77-17104 Original German report available from DFVLR, Cologne DM 49.60
(ESA-TT-359; DLR-FB-76-44) Avail: NTIS HC A07/MF A01

For an elastic aircraft model which can move in the wind tunnel with several degrees of freedom, the development and practical test of a multivariable controller is discussed. The controller stabilizes the elevation and the pitch angle, alleviates vertical gusts, and improves the damping of the first elastic mode. The control system synthesis depends on principles of optimization and simulation in the state space. Some low order linear filters are needed to meet the technical conditions.
Author (ESA)

N77-24149# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
COMPARISON OF SEVERAL MODELS DESCRIBING THE GUST LOADS ON AIRCRAFT STRUCTURES
O. Buxbaum and J. M. Zaschel 1976 50 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verkehr
(LBF-TB-130/76) Avail: NTIS HC A03/MF A01

Two gust models and their application in airworthiness regulations are described. Their suitability in determining static and fatigue strength of aircraft structures was investigated. The models considered were: discrete gust model based on a sequence of single isolated gusts, and a model of continuous turbulence accounting for turbulence as a stochastic process. The model of continuous turbulence was shown to improve the description of gust loads and the prediction of dynamic response, presuming that the statistical distribution of gust velocities and the transfer function of the aircraft under consideration are known. ESA

N77-24150# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
AIR CUSHION VEHICLE GROUND CONTACT DIRECTIONAL CONTROL DEVICES Special Report
Gunars Abele and Ronald A. Liston Dec. 1976 25 p refs
(DA Proj. 4A1-61101-A-91D)
(AD-A034825; CRREL-SR-76-45) Avail: NTIS HC A02/MF A01 CSCL 01/3

The maneuverability of air cushion vehicles can become a serious operational problem when the vehicle's travel route is restricted by obstacles, slopes or cross-wind conditions, or when close-quarter turns are required. While improvement and perfection of aerodynamic methods may be a more desirable approach, there is a practical limit to these methods, and the use of ground contact devices requires consideration for providing more positive directional control. Wheels deserve special attention, and therefore are analyzed in more detail because of their obvious application on a variety of land terrains. Brake rods and harrows are more suitable on water, ice, and snow. The saucer-shaped ground contact device would cause the least ecological impact on fragile organic terrains such as tundra. Relative directional stability is evaluated in terms of the total yawing moments produced by wheel arrangements (single, dual, tandem), location on the vehicle, and operational modes (free-rolling, braked, or a combination of the two). The available moments are plotted against the yaw angle of the vehicle to determine the most effective operational mode with a particular wheel arrangement for any yaw condition. The analysis is limited to retractable devices which act as moment producing brakes or rollers and do not serve as either propulsion or load support aids. Controlled ground contact with skirt sections having special wearing surfaces may provide a suitable control

method and would require the least significant change to the basic design of the vehicle or its components. The concept involves the use of an air flow control mechanism for deflating specific skirt sections. GRA

N77-24151# General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.
CONTROL POWER CRITERIA FOR STATICALLY UNSTABLE AIRCRAFT Final Report
Nov. 1976 71 p
(Contract N00019-75-C-0355)
(AD-A033969; CASD-NSC-76-003) Avail: NTIS HC A04/MF A01 CSCL 01/3

The sensitivity of control power requirements during gust response to variations in aircraft parameters and input disturbance levels has been investigated in an attempt to provide data useful in establishing design criteria and margins of safety needed in the control of aerodynamically unstable aircraft. Both canard configured and a conventional tail configured aircraft were used in this study. For both configurations the critical flight conditions were during the low-speed power approach. The critical gust frequency in terms of critical power requirement for a (1-cos) type gust was approximately twice the closed loop natural frequency of the aircraft. Static margin was found to be the primary quantity influencing the control power requirements. The sensitivity of required control power to variation in other aircraft parameters is predictable by the manner in which these parametric variations alter the static margin. The high angle of attack characteristics also had a significant effect on the control power requirements - indicating the need for a complete and accurate data base in this region. The gust upset boundaries dropped off sharply when the discrete gust was applied at a significant angle from the vertical. The control power requirements were found to be relatively insensitive to variations in the discrete gust mode shape in the absence of control surface rate saturation. Likewise, the increases in required control power due to increased gust magnitude were also relatively small when the surfaces were not rate saturated. When rate limits were reached, however, discrete gust magnitude and shape became more significant and those gust shapes that caused the longest periods of rate saturation were most critical. GRA

N77-24152# Air Force Academy, Colo. Frank J. Seiler Research Lab.
DECOUPLING CONTROL OF SYSTEMS WITH UNCERTAIN PARAMETERS DEFINED OVER A DISCRETE RANGE
Robert B. Asher and Robert J. Mulholland Dec. 1976 24 p refs
(AD-A034397; FJSRL-TR-76-0021) Avail: NTIS HC A02/MF A01 CSCL 01/3

The problem of decoupling of systems with parameter uncertainty is treated. The possible parameter values are defined over a discrete range. The conditions for decoupling are given as well as for disturbance isolation. Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N77-24153*# Old Dominion Univ., Norfolk, Va.
EVALUATION OF HYDROGEN AS A CRYOGENIC WIND TUNNEL TEST GAS Final Report
Richard C. Haut Apr. 1977 159 p refs
(Grant NGR-47-003-052)
(NASA-CR-145186) Avail: NTIS HC A08/MF A01 CSCL 14B

The nondimensional ratios used to describe various flow situations in hydrogen were determined and compared with the corresponding ideal diatomic gas ratios. The results were used to examine different inviscid flow configurations. The relatively high value of the characteristic rotational temperature causes the behavior of hydrogen, under cryogenic conditions, to deviate substantially from the behavior of an ideal diatomic gas in the compressible flow regime. Therefore, if an idea diatomic gas is to be modeled, cryogenic hydrogen is unacceptable as a wind tunnel test gas in a compressible flow situation. Author

N77-24154# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
USAGE OF LANDING MAT AS OVERLAY ON ASPHALT RUNWAY DURING MILITARY FIELD EXERCISES Final Report
Hugh L. Green Dec. 1976 77 p refs
(AD-A033914; WES-MP-S-76-24) Avail: NTIS HC A05/MF A01 CSCL 01/5

This report describes four military exercises conducted at Oak Grove, N. C., in which XM18 landing mat was placed over a deteriorating asphalt runway to provide a landing strip for C-130 cargo aircraft. In the past, studies had been conducted at the WES on this subject; however, this was the first opportunity to gain firsthand knowledge on the behavior of the aircraft and the landing mat during a field exercise. This report is based on Memorandums for Record (MFR's) prepared for each of the exercises, which were conducted over a four-year period. Details of each exercise are described in the MFR's, which are presented in their entirety as appendixes in this report. The lessons learned that may be helpful in future installations of landing mat over asphalt are listed in the form of conclusions and recommendations. This report should prove to be a valuable aid to a unit commander responsible for installation of landing mat over asphalt pavement. GRA

N77-24155# Calspan Corp., Buffalo, N.Y.
INTERFERENCE-FREE WIND-TUNNEL FLOWS BY ADAPTIVE-WALL TECHNOLOGY
W. R. Sears, R. J. Vidal, J. C. Erickson, Jr., and A. Ritter Jan. 1977 25 p refs Presented at the 10th Congr. of the Intern. Council of the Aeron. Sci., Ottawa, 3-8 Oct. 1976
(Contracts N00014-77-C-0052; N00014-72-C-0102)
(AD-A034889; CALSPAN-RK-6040-A-1; ICAS-Paper-76-02)
Avail: NTIS HC A02/MF A01 CSCL 14/2

The adaptive-wall or self-correcting wind tunnel has been proposed for such regimes as transonic and V/STOL where wall effects are large and cannot be corrected. The power and generality of the concept are pointed out. In a two-dimensional transonic embodiment in the Calspan One-Foot Tunnel, the scheme has been shown to work at lower transonic Mach numbers. Several practical problems are cited, including instrumentation, the nature of the wall modification, and convergence of the iterative procedure. Moreover, questions of shock-wave neutralization at the wall and probable configuration of three-dimensional embodiments are discussed. GRA

N77-24156# Army Aviation Center, Fort Rucker, Ala.
COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA) OF THE CH-47 FLIGHT SIMULATOR (CH47FS)
3 Dec. 1976 48 p refs
(AD-A033972) Avail: NTIS HC A03/MF A01 CSCL 14/2

The CH47FS CTEA Study Plan presents the purpose of the study and the terms of reference, including the problem statement, the objectives, scope, limits and assumptions, and the Essential Elements of Analysis (EEA). The alternative training packages selected for analysis and the Measures of Training Effectiveness (MOTE) are defined. The support and resource requirements for the study are listed and control procedures and the study schedule established. Included are also the methodology for analyzing training effectiveness, the operational test plan for generating effectiveness data, and the methodology for cost analysis. Author (GRA)

N77-24157# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
VIDEO GENERATION AND CONTROL SYSTEM Final Report, Jul. 1975 - Jun. 1976
Derryl A. Williams Aug. 1976 100 p
(AF Proj. 2003)
(AD-A033853; AFAL-TR-76-164) Avail: NTIS HC A05/MF A01 CSCL 14/2

The purpose of the Video Control Center is to generate, control, monitor, and record all standard video signals needed in AFAL/AA's simulation facility. Video signals may be generated live, from video tape, or from movie film. The video signals can be monitored at the console and distributed to a remote location such as the cockpit simulator. Special effects can be used to alter the signal. Cameras are available to observe the pilot's movements during a simulation. This information, as well as all other video signals, can be recorded on tape for future reference. The system can also serve as a training tool in that demonstration and instruction tapes can be produced. For example, the operation of the DAIS computer was demonstrated and recorded using the Video Control facility. The Flying Spot Scanner is designed to simulate a raster type sensor on an aircraft. The scanner is included in this report because it is a source of video and depends on control signals from the Video Control Center for operation. This report is a description of the Video Control Center and the Flying Spot Scanner. GRA

N77-24158# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF EJECTOR-POWERED ENGINE SIMULATORS FOR WIND TUNNEL MODELS Final Report, 30 Jan. - 30 Jun. 1976
G. D. Smith, R. J. Matz, and R. C. Bauer AEDC Jan. 1977 89 p refs Sponsored by the Air Force
(ARO Proj. RF-432; ARO Proj. R32P-92A)
(AD-A034725; ARO-ETF-TR-76-81; AEDC-TR-76-128) Avail: NTIS HC A05/MF A01 CSCL 01/2

Ejector-powered engine simulators (EPES) that produce representative engine inlet and exhaust effects in wind tunnel models are currently under investigation at the Arnold Engineering Development Center (AEDC). Studies summarized in this report include theoretical and experimental investigations of single-stage, cold-flow EPES and theoretical investigations of two-stage, cold-flow EPES and of single-stage EPES driven with heated jets. Existing AEDC jet pump and ejector-diffuser analytical models were used to predict EPES exhaust-to-inlet total pressure ratio, inlet airflow, and velocity distributions during the jet mixing process. GRA

N77-24159# Springfield Municipal Airport Board, Mo.
COMPREHENSIVE PLAN AND DEVELOPMENT PROGRAM FOR A REGIONAL INDUSTRIAL AIRPARK, SPRINGFIELD MUNICIPAL AIRPORT FOR THE CITY OF SPRINGFIELD, MISSOURI
Dec. 1976 128 p Prepared in cooperation with Thompson (Arnold) and Assoc., Inc., Chicago and Isbill Assoc., Inc., Denver
(Grant EDA-05-06-01565)
(PB-262474/0; EDA-77-011) Avail: NTIS HC A07/MF A01 CSCL 05C

The planning process for the regional industrial airpark to complement the Springfield Municipal Airport development is described. Several types of land uses were evaluated in proposing a recommended plan of implementation. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-24160*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
AUXILIARY PAYLOAD POWER SYSTEM STUDY FOR SPACE PROCESSING APPLICATIONS PAYLOADS. PRELIMINARY REQUIREMENTS STUDY
Jul. 1976 84 p
(Contract NAS8-31361)
(NASA-CR-150269) Avail: NTIS HC A05/MF A01 CSCL 22A

The preliminary designs, specifications, and programmatic data for the auxiliary payload power system (APPS) are presented. The APPS concept is an independent system to be carried in the Orbiter's cargo bay having the capability of housing and supporting space processing applications (SPA) experiment payloads and augmenting Spacelab power and heat rejection capabilities as required in the performance of these experiments. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N77-24161*# Battelle Columbus Labs., Ohio.
SEASAT B ORBIT SYNTHESIS Final Report
F. G. Rea and J. M. Warmke Jul. 1976 98 p
(Contract NASw-2800)
(NASA-CR-153003; BCL-OA-TFR-76-7) Avail: NTIS HC A05/MF A01 CSCL 22A

Addition were made to Battelle's Interactive Graphics Orbit Selection (IGOS) program; IGOS was exercised via telephone lines from JPL, and candidate SEASAT orbits were analyzed by Battelle. The additions to the program enable clear understanding of the implications of a specific orbit to the diverse desires of the SEASAT user community. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-24162*# Battelle Columbus Labs., Ohio.
PLANNING FOR A DATA BASE SYSTEM TO SUPPORT SATELLITE CONCEPTUAL DESIGN Final Report
Charles R. Claydon Nov. 1976 120 p
(Contract NASw-2800)
(NASA-CR-153008; BCL-OA-TFR-76-11) Avail: NTIS HC A06/MF A01 CSCL 22A

The conceptual design of an automated satellite design data base system is presented. The satellite catalog in the system includes data for all earth orbital satellites funded to the hardware stage for launch between 1970 and 1980, and provides a concise compilation of satellite capabilities and design parameters. The cost of satellite subsystems and components will be added to the base. Data elements are listed and discussed. Sensor and science and applications opportunities catalogs will be included in the data system. Capabilities of the BASIS storage, retrieval, and analysis system are used in the system design. Author

N77-24163*# Howard Univ., Washington, D.C. School of Engineering.
THE DYNAMICS AND OPTIMAL CONTROL OF SPINNING SPACECRAFT WITH MOVABLE TELESCOPING APPENDAGES. PART C: EFFECT OF FLEXIBILITY DURING BOOM DEPLOYMENT Final Report
Peter M. Bainum and Paul K. James May 1977 50 p refs
(Grant NsG-1181)
(NASA-CR-153220) Avail: NTIS HC A03/MF A01 CSCL 22B

The dynamics of a spinning symmetrical spacecraft system during the deployment (or retraction) of flexible boom-type

appendages were investigated. The effect of flexibility during boom deployment is treated by modelling the deployable members as compound spherical pendula of varying length (according to a control law). The orientation of the flexible booms with respect to the hub, is described by a sequence of two Euler angles. The boom members contain a flexural stiffness which can be related to an assumed effective restoring linear spring constant, and structural damping which effects the entire system. Linearized equations of motion for this system, when the boom length is constant, involve periodic coefficients with the frequency of the hub spin. A bounded transformation is found which converts this system into a kinematically equivalent one involving only constant coefficients. Author

N77-24164# Weapons Research Establishment, Salisbury (Australia).
A NEW TECHNIQUE FOR OBTAINING THE AERODYNAMICS OF MISSILES FROM FLIGHT TRIALS ON A GAS GUN RANGE
R. L Pope Nov. 1976 28 p refs
(WRE-TN-1719(WR/D)) Avail: NTIS HC A03/MF A01

A method is decribed for obtaining the low incidence, linear aerodynamic data for a missile from very simple free flight trials on a gas gun range. The images of two flashing lights, one in the nose and one in the tail of the free flight model, are recorded by three ballistic cameras. The positions of the lights are then calculated by a least squares solution of the resulting triangulation problem. The velocity of the centre of gravity and the attitude of the vehicle are estimated from the position measurements for the nose and the tail. A parameter estimation technique using the output error criterion is applied to the attitude and velocity data to obtain aerodynamic terms. The method was used successfully to estimate axial force, normal force, static stability and pitch damping moment for the test vehicle. Author

N77-24165*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
SEVERE STORMS OBSERVING SATELLITE STUDY Final Report
R. P. Iwens and D. A. Stern 30 Jun. 1976 224 p refs
(Contract NAS5-20811)
(NASA-CR-152509; TRW-26813-6003-RU-00) Avail: NTIS HC A10/MF A01 CSCL 22B

Payload distribution and the attitude control system for the multi-mission modular spacecraft/StormSat configuration are discussed. The design of the advanced atmospheric sounder and imaging radiometer (AASIR) gimbal drive and its servomechanism is described. Onboard data handling, data downlink communications, and ground data handling systems are developed. Additional topics covered include: magnetic unloading at synchronous altitude, north-south stationkeeping, and the feasibility and impact of flying the microwave atmospheric sounding radiometer (MASR) as an additional payload. A.R.H.

N77-24166# Lockheed Missiles and Space Co., Palo Alto, Calif.
RADUGA IN STATIONARY ORBIT
G. Irinin and B. Zhurin [1977] 2 p Transl. into ENGLISH from Aviats. i Kosmonav. (USSR), no. 1, 1977 p 37
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Orbit parameters of the Raduga satellite are discussed. This relay satellite assures continuous round-the-clock radiotelephone/telegraph communication in the centimeter waveband and simultaneous transmission of color and black and white Central Television programs to the network of Orbita stations. Systems on the satellite, in addition to the perfected multitrunk relay apparatus, are: triaxial accurate orientation towards earth; a power supply with independent pointing of the solar panels towards and tracking of the sun; orbit correction; thermoregulation; radio telemetry to transmit data about onboard systems operation to earth; and a radio system for exact measurement of the orbit parameters and satellite control. A.R.H.

N77-24167*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PUBLIC SERVICE COMMUNICATIONS SATELLITE USER BROCHURE
Feb. 1977 17 p ref
(NASA-TM-X-74622) Avail: NTIS HC A02/MF A01 CSCL 22A

The capabilities of a proposed communications satellite that would be devoted to experiments and demonstrations of various public services is described. A Public Service Communications Satellite study was undertaken at the NASA Goddard Space Flight Center (GSFC) to define the problems and opportunities of a renewed NASA role and the form such NASA involvement should take. The concept that has evolved has resulted from careful consideration of experiments that were already undertaken on existing satellites. Author

N77-24168# General Electric Co., Philadelphia, Pa.
VALIDATED HYBRID SIMULATION PROVIDES FLEXIBLE AVIONICS TESTING FOR MACH 20 RE-ENTRY VEHICLE
F. P. Laska 9 May 1977 28 p
(DOC-77SDR020) Avail: GE/Space and RESD Libraries, P. O. box 8555, Philadelphia, Pa. 19101 MF $10.00/HC $10.00

NOTICE: Available to NASA Offices and NASA Research Centers.

A real-time, hybrid, six-degree-of-freedom simulation was developed for use for test verification of the Navigation, Guidance, and Control Subsystem of a Maneuvering Re-entry Vehicle. The simulation employs analog and digital computers interfaced to an air-borne digital computer which provides the guidance and control functions. Additional avionics equipment can be substituted into the simulation in order to enable a full closed loop exercise of the subsystem. The simulation structure is described, the computer and hardware interfaces are explained, and the testing methodology used to verify the subsystem prior to flight is shown. Author

N77-24169*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DYNAMIC STABILITY CHARACTERISTICS OF THE COMBINATION SPACE SHUTTLE ORBITER AND FERRY VEHICLE
Delma C. Freeman, Jr. and Richmond P. Boyden Washington May 1977 115 p refs
(NASA-TM-X-3497; L-11131) Avail: NTIS HC A06/MF A01 CSCL 22B

Subsonic forced-oscillation tests of a 0.015 scale model of the space shuttle orbiter/747 ferry vehicle were conducted in the Langley high speed 7- by 10-foot tunnel at Mach numbers of 0.2, 0.4, and 0.5 for angles of attack up to 12 deg. Tests were made of the basic 747 airplane, of the modified 747 (tip fins and struts added), of the ferry configuration, (747 plus orbiter at an incidence angle of 3 deg), and of the approach and landing test configuration (747 plus orbiter at an incidence angle of 6 deg). Author

N77-24170*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
DESIGN STUDY OF TDRS ANTENNA GIMBAL SYSTEM FOR LANDSAT-D
J. Wu Apr. 1977 71 p refs
(Contract NAS5-23725)
(NASA-CR-152514; TRW-30722-6001-RU-00) Avail: NTIS HC A04/MF A01 CSCL 22B

The conceptual design studies of a two axis antenna drive assembly for the TDRSS link communications subsystem for LANDSAT D are presented. The recommended antenna drive assembly is a simple and reliable design substantially similar to the antenna and solar array drives developed and space qualified for programs such as DSCS 2 and FltSatCom. The gimbal design tradeoff is presented, along with drive electronics. Author

N77-24171*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
DESIGN STUDY FOR LANDSAT-D ATTITUDE CONTROL SYSTEM Final Technical Report
R. P. Iwens, G. E. Bernier, R. F. Hofstadter, R. A. Mayo, and H. Nakano Feb. 1977 396 p refs
(Contract NAS5-21188)
(NASA-CR-152515; TRW-14897-6010-RU-00) Avail: NTIS HC A17/MF A01 CSCL 22B

The gimballed Ku-band antenna system for communication with TDRS was studied. By means of an error analysis it was demonstrated that the antenna cannot be open loop pointed to TDRS by an onboard programmer, but that an autotrack system was required. After some tradeoffs, a two-axis, azimuth-elevation type gimbal configuration was recommended for the antenna. It is shown that gimbal lock only occurs when LANDSAT-D is over water where a temporary loss of the communication link to TDRS is of no consequence. A preliminary gimbal control system design is also presented. A digital computer program was written that computes antenna gimbal angle profiles, assesses percent antenna beam interference with the solar array, and determines whether the spacecraft is over land or water, a lighted earth or a dark earth, and whether the spacecraft is in eclipse. Author

N77-24172# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OBSERVING ARTIFICIAL SATELLITES
Laurence G. Taff 8 Oct. 1976 26 p refs
(Contract F19628-76-C-0002)
(AD-A034644; ESD-TR-76-309; ETS-4) Avail: NTIS HC A03/MF A01 CSCL 17/8

This report describes a technique that can be used to derive the penalty paid, in terms of increased apparent magnitude, for not observing artificial satellites at their maximum diffuse brightness. The procedure is applied here to the simple case of geostationary right-circular cylinders. We find that if these satellites (at their brightest) are 0.5 magnitude brighter than the system limit, then approximately. 63 percent of all such satellites within 60 deg of the GEODSS ETS will never be visible. Author (GRA)

N77-24173# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Systems Concepts Office.
FREE ROCKET SIX DEGREE OF FREEDOM DIGITAL SIMULATION
Mickie P. Stamps 8 Nov. 1976 34 p
(AD-A034920; RF-77-1) Avail: NTIS HC A03/MF A01 CSCL 19/7

This report describes in detail a free rocket six degree of freedom trajectory program which utilizes a fourth order RUNGE-KUTTA subroutine. Several options such as programmed roll, directional control, and fold out fins are described. The program includes a listing of the equations, flow charts, program description, input and output information, and a complete program listing. Author (GRA)

N77-24174# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DETERMINATION OF SPECULAR REFLECTION FROM CYLINDRICAL SATELLITES FOR ELECTRO-OPTICAL SURVEILLANCE AND SOI
Alan S. Friedman 8 Oct. 1976 33 p
(Contract F19628-76-C-0002; AF Proj. 2128)
(AD-A034580; ETS-3; ESD-TR-76-308) Avail: NTIS HC A03/MF A01 CSCL 17/8

An analysis of the timing and duration of observable specular reflections from cylindrical satellites is presented, taking into account orbital elements, attitude and axial misalignment (wobble). Results are displayed in the form of computer-generated graphic tables. Author (GRA)

N77-24175# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PERFORMANCE OF AN AIR-TO-GROUND MISSILE EMPLOYING SAR-RETRAN GUIDANCE M.S. Thesis
Edwin H. Jessup Dec. 1976 229 p refs
(AD-A034941; GAE/MC/76D-6) Avail: NTIS HC A11/MF A01 CSCL 17/9

The compatibility of a representative 500 pound weight boost-glide air-to-ground missile with the trajectory constraints imposed by a Synthetic Aperture Radar - Retransmission guidance system was investigated using a digital flight simulation. A demonstration flight profile was assumed, with a minimum of 20 seconds of tracking on the aircraft-to-target line of sight required. A guidance algorithm was developed which produced satisfactory trajectories. A first order gradient technique was employed in an unsuccessful attempt to optimize the trajectories for maximum range. A useable launch envelope for this missile was determined. The azimuthal extent of the envelope was limited by radar system constraints to 15 deg-90 deg from the aircraft velocity vector. A maximum slant range of 21 nautical miles was obtained from a launch altitude of 35,000 ft. Range deteriorated rapidly with decreasing launch altitude, with 5,000 ft being the lowest altitude at which a useable launch envelope was obtained. Maximum slant range at 5,000 ft launch altitude was 5.5 nautical miles. Author (GRA)

N77-24176# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.
SOUNDING ROCKET DELTA VELOCITY SYSTEM
Edward F. McKenna 8 Oct. 1976 14 p
(AF Proj. 7659)
(AD-A034435; AFGL-TR-76-0241; AFGL-IP-251) Avail: NTIS HC A02/MF A01 CSCL 19/7

A sounding rocket tumble system to enhance deceleration and redirect the flight path angle of a vehicle can be an effective means of accomplishing large spacial separation between a separated payload and the spent final stage rocket motor. The design and implementation of two such systems, for 9-in. - and 17-in. -diam payloads, is presented. Flight test results show that separation distances between payload and vehicle in the order of 10 percent of vehicle apogee can be achieved. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N77-24177# ARO, Inc., Arnold Air Force Station, Tenn.
SIMULATED THERMAL PROTECTION TILE ROUGHNESS EFFECTS ON WINDWARD SURFACE HEAT TRANSFER ON THE ROCKWELL INTERNATIONAL SPACE SHUTTLE ORBITER Final Report, 14 Nov. - 10 Dec. 1975
F. K. Hube AEDC Jan. 1977 63 p refs
(AD-A034733; ARO-VKF-TR-76-26; AEDC-TR-76-98) Avail: NTIS HC A04/MF A01 CSCL 22/2

Heat transfer tests on the forward half of the 0.04-scale models of the Rockwell International Space Shuttle Orbiter Configuration 140C were conducted at Mach number 8. Infrared scanning was used to determine the influence of simulated thermal protection tile roughness on windward surface heat transfer level and distribution. Tile roughness was in the form of tile surface mismatch and gaps between tiles. Tile height (measured from the smooth body wall) ranged from -0.020 in. (cavity) to 0.025 in. (protuberance), and gap width ranged from 0 to 0.020 in. Data were obtained at angles of attack of 30 to 40 deg at zero side-slip at free-stream Reynolds numbers from 2,200,000 to 15,100,000 based on the total Orbiter scaled length. The infrared system is described, and data are presented which illustrate the influence of the major test parameters. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N77-24178*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
Mu-2 RANGING
W. L. Martin and A. I. Zygielbaum 15 May 1977 81 p refs
(Contract NAS7-100)
(NASA-CR-153059; JPL-TM-33-768) Avail: NTIS HC A05/MF A01 CSCL 22D

The Mu-II Dual-Channel Sequential Ranging System designed as a model for future Deep Space Network ranging equipment

is described. A list of design objectives is followed by a theoretical explanation of the digital demodulation techniques first employed in this machine. Hardware and software implementation are discussed, together with the details relating to the construction of the device. Two appendixes are included relating to the programming and operation of this equipment to yield the maximum scientific data. Author

N77-24179*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE VIKING 1975 MISSION TO MARS. VOLUME 2: LAUNCH THROUGH LANDING OF VIKING 1
D. J. Mudgway and M. R. Traxler 15 Mar. 1977 260 p refs (Contract NAS7-100)
(NASA-CR-153062; JPL-TM-33-783-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 22D

Problems inherent in the deployment and management of a worldwide tracking and data acquisition network to support the two Viking Orbiters and two Viking Landers simultaneously over 320 million kilometers (200 million miles) of deep space are discussed. Activities described include tracking coverage of the launch phase, the deep space operations during the long cruise phase that occupied approximately 11 months, and the implementation of the a vast worldwide network of tracking sttions and global communications systems. The performance of the personnel, hardware, and software involved in this vast undertaking are evaluated. Author

N77-24180# Wyoming Univ., Laramie. Dept. of Mechanical Engineering.
A LASER SYSTEM FOR DETERMINATION OF ROCKET ATTITUDE USING TWO GROUND STATIONS Final Report, 10 Nov. 1975 - 9 Nov. 1976
John E. Nydahl and Kynric M. Pell Dec. 1976 89 p refs (Contract DAAG29-76-G-0073)
(AD-A034785; UWME-DR-6051101; ARO-13640.1-A-E) Avail: NTIS HC A05/MF A01 CSCL 17/9

A system that can measure the attitude of a spinning rocket when coupled with a laser radar tracker was investigated. The attitude sensing system consists of at least two ground based laser transmitter/detector stations which illuminate the rocket with continuous wave lasers as it moves downrange. Pulses that are reflected from two roof type prisms onboard the spinning vehicle back to the two transmitting stations along with position data obtained from the tracking laser radar form the basis for determining the missile's pitch and yaw. A static bench scale demonstration, a dynamic computer simulation and sensitivity analysis of this concept all continue to support this system as a viable alternative to the current photographic technique for determining missile attitude. Author (GRA)

N77-24181# Science Applications, Inc., Huntsville, Ala.
COMPARISON OF THE PERIMETER ACQUISITION RADAR (PAR) SATELLITE TRACK CAPABILITY TO THE SPACE DEFENSE CENTER (SDC) SATELLITE CATALOGUE: UNKNOWN SATELLITE TRACK EXPERIMENT, VOLUME 1
J. K. Hendren and A. Anderson 13 Oct. 1976 54 p refs (Contract DASG60-76-C-0011)
(AD-A034014; SAI-77-701-HU-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17/9

This experiment was performed by SAI under direction of BMDSC-W at the request of ADCOM. The purpose of the experiment is to determine the PAR's capability to detect and track objects that are not in the Space Defense Center (SDC) satellite catalogue, to determine the PAR's capability to reduce the potential for space tragedy for NASA's manned missions by supplementing the catalogue, and to determine some of the characteristics of the objects seen by the PAR that are not in the catalogue. The report is divided into two volumes. In Volume I is an overview of the analysis methods, and the bulk of the results, and recommendations and conclusions. In Volume 2 are the details of the analysis methods, and a set of plots showing the Radar Cross Section (RCS) distributions for PAR tracks for both those that correlated with the catalogue and those that did not for various altitude bands. Author (GRA)

N77-24182# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
HIGH ACCURACY AIRCRAFT TO SATELLITE TRACKING: AN EVALUATION OF TWO PROPOSED FILTER MODELS M.S. Thesis
Robert E. Mann, Jr. Dec. 1976 144 p refs
(AD-A034272; GE/EE/76-33) Avail: NTIS HC A07/MF A01 CSCL 17/9

This study treats the high accuracy tracking of a satellite from an aircraft. The purpose is to evaluate the feasibility of several reduced order system models for implementation in an extended Kalman filter formulation whose estimates would be used to aid the tracker. The first filter model is a twelve state model in which filter estimates of the satellite inertial position and velocity are obtained and used in the estimation of the tracker states. A second, six state-model deletes these six satellite states, and tracker state estimation is accomplished by exploiting the information already available in the tracking geometry, dominant modes of satellite dynamics, and the range measurement. Tracker state estimation is accomplished in the line of sight coordinate frame for both filter formulations. A covariance analysis was performed, evaluating each filter against a 42 state truth model. The tracking profile used in the study was specifically designed to evaluate each filter's state estimation capability when faced with a highly nonlinear tracker angular rate history. It was concluded that the six state filter is a viable alternative, and, with some proposed modifications, is preferable (because of its simplicity and lower computational burden) and warrants further study. Author (GRA)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-24183*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL PERFORMANCE OF AN INTEGRATED THERMAL PROTECTION SYSTEM FOR LONG-TERM STORAGE OF CRYOGENIC PROPELLANTS IN SPACE
Richard L. DeWitt and Robert J. Boyle Washington May 1977 109 p refs
(NASA-TN-D-8320; E8881) Avail: NTIS HC A06/MF A01 CSCL 22B

It was demonstrated that cryogenic propellants can be stored unvented in space long enough to accomplish a Saturn orbiter mission after 1,200-day coast. The thermal design of a hydrogen-fluorine rocket stage was carried out, and the hydrogen tank, its support structure, and thermal protection system were tested in a vacuum chamber. Heat transfer rates of approximately 23 W were measured in tests to simulate the near-Earth portion of the mission. Tests to simulate the majority of the time the vehicle would be in deep space and sun-oriented resulted in a heat transfer rate of 0.11 W. Author

N77-24184# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Aeroballistics Directorate.
A STUDY OF VARIOUS SLENDER AND NON-SLENDER FIN-BODY COMBINATIONS OF MISSILE CONFIGURATIONS
N. Uchiyama and J. M. Wu 12 Nov. 1976 189 p refs
(AD-A034201; RD-CR-76-5) Avail: NTIS HC A09/MF A01 CSCL 19/7

The aerodynamic loading on a number of rocket body-control surface combinations has been calculated using methods developed at the University of Tennessee Space Institute over the past five years. Variations in control surface planform, roll angle, control surface deflection or incorporation of elevons, are included. Compressibility is accounted for. Details of the digital computer program are included. GRA

N77-24185# Massachusetts Inst. of Tech., Cambridge.
ABSTRACTS
Aug. 1976 127 p refs Presented at the 1976 AFOSR Contractors Meeting on Air-Breathing Combust. Dyn., Wright-Patterson, AFB, Ohio, 11-13 Aug. 1976
(Grant AF-AFOSR-2619-74)
(AD-A033035; AFOSR-76-0815TR) Avail: NTIS HC A07/MF A01 CSCL 19/7

The report consists of a collection of abstracts of the numerous research progress reports given by AFOSR contractors and of invited papers from other governmental agencies and contractors. These papers presented over a three-day period composed the 1976 annual contractors meeting on air-breathing combustion dynamics. The principal investigators and their organizational association are also identified. Author (GRA)

N77-24186# Naval Academy, Annapolis, Md.
THE DESIGN, CONSTRUCTION AND FLIGHT TESTING OF A LARGE LIQUID PROPELLANT MISSILE
David E. Crisalli 3 Jun. 1976 67 p refs
(AD-A032714; USNA-TSPR-76) Avail: NTIS HC A04/MF A01 CSCL 19/7

The paper describes the design, construction, and testing of a liquid fueled rocket. Design calculations for the engine and propulsion systems were performed, checked, and an engine was constructed to those specifications. A static test stand was constructed and instrumented to evaluate engine performance during full duration static firings. The engine and propulsion system proved successful and were then incorporated into the flight vehicle. The remainder of the paper describes the design, construction, and testing of all flight hardware including an on-board camera system and recovery system. Two unsuccessful attempts to launch the missile were made on 11 May 1976 at White Sands Missile Range in New Mexico. The reasons for the failure were corrected and the missile was succesfully launched on 17 May 1976. Author (GRA)

N77-24187# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A FUEL CONSERVATION NEAR-OPTIMAL CONTROL LAW FOR AN EVADING SPACECRAFT M.S. Thesis
William V. Green Dec. 1976 81 p refs
(AD-A034945; GA/MC/76D-8) Avail: NTIS HC A05/MF A01 CSCL 22/2

A fuel conservation control law for an evading spacecraft is tested in a free final time, pursuit-evasion differential game. A form of differential dynamic programming with periodic updating is used to solve the optimal control problem. The control law is tested against two different finds of pursuers. One of the pursuers is using the same updating of the optimal control scheme and the other pursuer is using a non-optimal control law. The non-optimal control law produces a collision course between the two craft. The evader is able to take advantage of any non-optimal play by the pursuer. The evader is able to optimize the combination of final range and final mass, depending on the mission. Plots comparing the flight path of the evader and several different pursuers are included. Author (GRA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-24188*# Rocketdyne, Canoga Park, Calif.
LASER-HEATED ROCKET THRUSTER Final Report, Jun. 1975 - Jun. 1976
J. M. Shoji 12 Apr. 1977 187 p refs
(Contract NAS3-19728)
(NASA-CR-135128; R76-104) Avail: NTIS HC A09/MF A01 CSCL 21H

A space vehicle application using 5,000-kw input laser power was conceptually evaluated. A detailed design evaluation of a 10-kw experimental thruster including plasma size, chamber size, cooling, and performance analyses, was performed for 50 psia chamber pressure and using hydrogen as a propellant. The 10-kw hardware fabricated included a water cooled chamber, an uncooled copper chamber, an injector, igniters, and a thrust stand. A 10-kw optical train was designed. Author

N77-24189*# Aerotherm Corp., Mountain View, Calif.
BOUNDARY LAYER INTEGRAL MATRIX PROCEDURE: VERIFICATION OF MODELS Final Report
William S. Bonnett and R. Michael Evans Apr. 1977 74 p refs
(Contract NAS8-31961; Aerotherm Proj. 7239)
(NASA-CR-150271; AEROTHERM-77-239) Avail: NTIS HC A04/MF A01 CSCL 21H

The three turbulent models currently available in the JANNAF version of the Aerotherm Boundary Layer Integral Matrix Procedure (BLIMP-J) code were studied. The BLIMP-J program is the standard prediction method for boundary layer effects in liquid rocket engine thrust chambers. Experimental data from flow fields with large edge-to-wall temperature ratios are compared to the predictions of the three turbulence models contained in BLIMP-J. In addition, test conditions necessary to generate additional data on a flat plate or in a nozzle are given. It is concluded that the Cebeci-Smith turbulence model be the recommended model for the prediction of boundary layer effects in liquid rocket engines. In addition, the effects of homogeneous chemical reaction kinetics were examined for a hydrogen/oxygen system. Results show that for most flows, kinetics are probably only significant for stoichiometric mixture ratios. Author

N77-24190*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE 6670-NEWTON ATTITUDE-CONTROL THRUSTER USING HYDROGEN-OXYGEN PROPELLANT
Larry H. Gordon Washington May 1977 39 p refs
(NASA-TM-X-3523; E-8981) Avail: NTIS HC A03/MF A01 CSCL 21H

The development of a reusable, attitude-control propulsion system for the space transportation system is discussed. A flight weight, gaseous oxygen attitude control thruster assembly was tested to obtain data on cyclic life, thermal and hydraulic characteristics, pulse response, and performance. The basic thruster components were tested in excess of 51,000 pulses and 660 seconds, steady state, with no degradation of the 93 percent characteristic exhaust velocity efficiency level. Nominal operating conditions were a chamber pressure of 207 N sq cm (300 psia), a mixture ratio of 4.0, a pulse width of 100 ms, and a pulse frequency of 2 Hz. Author

N77-24191*# National Aeronautics and Space Administration, Washington, D. C.
LIQUID ROCKET DISCONNECTS, COUPLINGS, FITTINGS, FIXED JOINTS, AND SEALS NASA Space Vehicle Design Criteria (Chemical Propulsion)
Sep. 1976 164 p refs
(NASA-SP-8119) Avail: NTIS HC A08/MF A01 CSCL 21H

State of the art and design criteria for components used in liquid propellant rocket propulsion systems to contain and control

the flow of fluids involved are discussed. Particular emphasis is placed on the design of components used in the engine systems of boosters and upper stages, and in spacecraft propulsion systems because of the high pressure and high vibration levels to which these components are exposed. A table for conversion of U.S. customary units to SI units is included with a glossary, and a list of NASA space vehicle design criteria monographs issued to September 1976. A.R.H.

N77-24192# Purdue Univ., Lafayette, Ind. SQUID Headquarters.
APPLICABILITY OF LASER RAMAN SCATTERING DIAGNOSTIC TECHNIQUES TO PRACTICAL COMBUSTION SYSTEMS Technical Report, 28 Jan. - 31 Aug. 1976
Alan C. Eckbreth Oct. 1976 96 p refs Prepared by United Technol. Res. Center
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A032492; SQUID-TR-UTRC-4-PU; UTRC-R76-952296-2) Avail: NTIS HC A05/MF A01 CSCL 20/6

Laser Raman scattering techniques for combustion diagnosis have undergone considerable development in the past several years and are now being employed in a number of fundamental flame investigations. However, from an instrumentation viewpoint, practical combustion environments can differ greatly from the flames typically employed in fundamental studies. In particular, pulsed laser Raman thermometry experiments have shown laser modulated particulate (soot) incandescence to be an especially severe problem. Particles in the measurement volume, which, at flame temperatures, are already incandescent and contribute significantly to the total luminous emission, absorb the incident Raman inducing laser radiation, heat to temperatures far above ambient, and emit greatly increased amounts of gray/blackbody radiation which can exceed the sought-for Raman signal levels by several orders of magnitude. Under Project SQUID sponsorship, a detailed study of this phenomenon has been conducted, the results of which are reported herein. GRA

N77-24193# Aerodyne Research, Inc., Bedford, Mass.
GROWTH OF CARBON PARTICLES IN ROCKET EXHAUST Final Scientific Report, 1 Sep. 1973 - 30 Sep. 1976
David M. Mann Nov. 1976 37 p refs
(Contract F44620-74-C-0005)
(AD-A033892; ARI-RR-92; AFOSR-76-1423TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

The specific approach taken in this work was to study particle formation in a cooling jet of carbon vapor diluted by an inert carrier gas. Vapor was produced by the evaporation of a resistance heated graphite tube. The carbon vapor, mixed with carrier gas, flowed into a light scattering chamber where spectroscopic measurements were used to monitor concentrations of molecular species. Particles were also collected for electron microscopy. An initial reaction leading to particle formation was identified as C2-C3 yields C5 with a gas kinetic rate. Particulates were found to be spherical, of approximately equal diameter and frequently chained in the manner of hydrocarbon soot. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N77-24194*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EQUATION THAT DESCRIBES MATERIAL OUTGASSING FOR CONTAMINATION MODELING
Thomas M. Heslin Washington May 1977 17 p refs
(NASA-TN-D-8471; G7702F5) Avail: NTIS HC A02/MF A01 CSCL 07D

A generalization of the Clausius-Claperon equation for vapor pressure is made for an outgassing material. The expression is derived using Langmuir's equation for the outgassing rate of a material and using an empirical equation for the vapor pressure of a material as a function of its molecular weight and temperature. Also, outgassing rate equations are derived in terms of the vapor pressure of the outgassing material for three general geometries. Author

N77-24195# Northwestern Univ., Evanston, Ill. Materials Research Center.
BASIC AND APPLIED RESEARCH IN MATERIALS Annual Technical Report, 1 Jun. 1975 - 30 Jun. 1976
J. Wagner 30 Jun. 1976 18 p refs
(Contract N00014-75-C1116; ARPA Order 3017)
(AD-A034074) Avail: NTIS HC A02/MF A01 CSCL 10/3

This report describes the research carried out in two major areas: (1) materials for energy storage and (2) heterogeneous catalysis, materials for energy storage. The discovery of new types of solid electrolytes (such as beta alumina, RbAg4I5, copper and silver halides and stabilized zirconia) with large values of ionic conductivity at relatively low temperatures has enhanced the prospect of developing battery systems possessing a high energy storage-to-weight ratio, high power output capability, long life in service, efficiency in charge-discharge characteristics and the capability of being constructed from inexpensive, readily obtainable materials. Heterogeneous catalysis: a number of the most important heterogeneous catalysts consist of tiny crystallites of metal supported upon a carrier such as silica or alumina. The support leads to a greater metallic surface area per gram of metal and permits use of the catalyst at temperatures up to 500 C without rapid sintering. However, relatively little is known of the exact nature of the crystallites (including the nature of their attachment to the support), the effect of the support upon the catalyst behavior, the effect of the method of catalyst preparation upon catalytic activity. It is the purpose of this project to provide some resolution of these problems. Author (GRA)

N77-24196# Materials Research Labs., Maribyrnong (Australia).
PROCEEDINGS OF THE 2D ORGANIC COATINGS SYMPOSIUM
J. T. Hinde Sep. 1976 69 p refs Symp. held at Maribyrnong, Australia, 6 Aug. 1975
(AD-A034407; MRL-R-671) Avail: NTIS HC A04/MF A01 CSCL 11/3

The Proceedings of the Second Organic Coatings Symposium at Materials Research Laboratories provides details of the nine lectures delivered. In addition to recent technical developments in paints the lecture covers such aspects as the formation of phosphate and chromate conversion coatings, assessment of camouflage systems, factors affecting paint deterioration, and the prevention of fungal growth on paints. In addition the problem areas of particular interest to the Services are discussed. Author (GRA)

N77-24197# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
SYNTHESIS OF ORGANOFLUORINE COMPOUNDS BY DIRECT FLUORINATION Final Report, 1 Mar. 1974 - 30 Jun. 1976
Richard J. Lagow 1976 10 p
(Grant AF-AFOSR-2691-74; AF Proj. 9538)
(AD-A033833; AFOSR-76-1305TR) Avail: NTIS HC A02/MF A01 CSCL 07/2

The objective of this research is to utilize a new fluorination technique for making fluorocarbon oligomers and polymers. The work will provide methods for synthesizing monomers and oligomers useful in making fluorocarbon ether elastomers. The research is aimed at the utilization of a direct fluorination technique for the conversion of organic compounds, particularly oxygen-containing organic compounds to polymerizable difunctional perfluorinated monomers and oligomers. Author (GRA)

N77-24198# Boston Univ., Mass. Dept. of Chemistry.
PHOTOISOMERIZATION OF LINKED ANTHRACENSES. A DEMANDING TEST OF MOLECULAR GEOMETRY FOR INTERMEDIATES IN PHOTODIMERIZATION Technical Report, 1 Nov. 1975 - 31 Aug. 1976
William R. Bergmark and Guilford Jones, II 1 Dec. 1976 11 p refs Submitted for publication Sponsored in part by NSF
(Contract N00014-76-C-0442; NR Proj. 051-574)
(AD-A034176; TR-5) Avail: NTIS HC A02/MF A01 CSCL 07/3

Valence photoisomerization and photophysical properties of

a series of dianthry-lethanes, dianthrylmethanes, and tetrabenzo(2.2)paracyclophane are reported. Fluorescence lifetimes and quantum yields depend upon the nature of the linkage between anthracene moieties. Quantum efficiency for photoisomerization depends on the substitution pattern at 10,10 prime positions. Sandwich dimers with excimer-like interaction are generated on low temperature photolysis in glasses of dianthrylethane but not dianthrylmethane. It is concluded that geometrical requirements for excimerization and photodimerization are quite different.
Author (GRA)

24 COMPOSITE MATERIALS

Includes laminates.

N77-24199*# Lockheed-California Co., Burbank.
FLIGHT SERVICE EVALUATION OF KEVLAR-49/EPOXY COMPOSITE PANELS IN WIDE-BODIED COMMERCIAL TRANSPORT AIRCRAFT Annual Report
R. H. Stone Mar. 1977 42 p refs
(Contract NAS1-11621)
(NASA-CR-145141; AR-3) Avail: NTIS HC A03/MF A01 CSCL 11D

Kevlar-49 fairing panels, installed as flight service components on three L-1011s, were inspected after three years' service, and found to be performing satisfactorily. There are six Kevlar-49 panels on each aircraft, including sandwich and solid laminate wing-body panels, and 150 C service aft engine fairings. The service history to date indicates that Kevlar-49 epoxy composite materials have satisfactory service characteristics for use in aircraft secondary structure.
Author

N77-24200*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ABRASION RESISTANT COATINGS FOR PLASTIC SURFACES Patent Application
John R. Hollahan (Tegal Corp., Richmond, Calif.) and Theodore Wydeven, Jr., inventors (to NASA) Filed 16 May 1977 13 p
(NASA-Case-ARC-10915-3; US-Patent-Appl-SN-797217) Avail: NTIS HC A02/MF A01 CSCL 11D

Abrasion resistant protective coatings for plastic surfaces such as acrylics, polystyrenes, and polycarbonates are provided by the plasma polymerization of at least one member of a group of organosilane compounds. The group consists of vinyltrichlorosilane, tetraethoxysilane, vinyltriethoxysilane, tetravinylsilane, vinyltriacetoxysilane, hexamethyldisilazane, tetramethylsilane, vinyldimethylethoxysilane, vinyltrimethoxysilene and methyltrimethoxysilane. Plasma polymerization of these organosilane compounds provides an abrasion resistant protective coating for plastic optical surfaces together with a uniform optically clear layer in the 4,000 to 8,000 angstrom range.
NASA

N77-24201# Westinghouse Research Labs., Pittsburgh, Pa.
PROGRESS TOWARD A PRACTICAL Nb-Ge CONDUCTOR
A. I. Braginski, J. R. Cavaler, G. W. Roland, M. R. Daniel, M. A. Janocko, and A. T. Santhanam 1976 7 p refs Presented at Appl. Superconductivity Conf., Stanford, Calif., 17 Aug. 1976
(Contract EY-76-C-02-2522)
(COO-2522-6; Conf-760829-45) Avail: NTIS HC A02/MF A01

Properties of high-T/sub c/Nb-Ge films deposited by sputtering and by chemical vapor deposition (CVD) were investigated. Results of sputtering in the presence of controlled levels of O2, N2, Si, and of reactive sputtering in Ar-GeH4, suggest that the high-T/sub c/A15 phase is impurity- or defect-stabilized. In CVD deposits two tetragonal modifications were found: sigma and T2, the latter probably stabilized by Cl2. High critical current densities, J/sub c/ (H, T) of fine-grained sputtered films are attributed to flux pinning on A15 grain boundaries. Comparably high J/sub c/'s were also obtained in CVD A15 films doped with impurities. Low field ac losses p (H, T) were correlated with J/sub c/ and coating geometries. The feasibility of fabricating multifilamentary composite conductors by CVD was demonstrated experimentally.
ERA

N77-24202# Army Construction Engineering Research Lab., Champaign, Ill.
EVALUATION OF LOAD-BEARING HONEYCOMB CORE SANDWICH PANELS Final Report
Edward J. Worrell and Bruce H. Wendler Nov. 1976 59 p refs
(DA Proj. 4A7-62619-AT-41)
(AD-A033755; CERL-TR-D-75) Avail: NTIS HC A04/MF A01 CSCL 13/3

The report describes an investigation of the performance of three-ply and five-ply paper honeycomb core sandwich panels. The core of the three-ply material consisted of metallic skins bonded to a cellular paper ply; the five-ply construction had 1/8-in.(3.2 mm) hardboard or asbestos board bonded to the metal skin which was bonded to the honeycomb paper. The panels were tested for fire safety, superficial damage, thermal conductivity, and durability. It was found that addition of backup plies did not significantly affect performance in thermal conductivity, durability, or large import loads; however, a significant increase in performance was achieved in localized superficial damage and five endurance times. The improved fire performance of the five-ply panels was still decidedly inferior to that of conventional wood stud construction. Further study should be made to determine if simple changes in the basic design of the panel are available which could bring the fire performance up to the level of conventional construction.
GRA

N77-24203# Rockwell International Science Center, Thousand Oaks, Calif.
IMPACT DAMAGE IN CARBON/CARBON COMPOSITES Technical Report, 1 May - 31 Dec. 1976
A. G. Evans, W. F. Adler, and J. C. Chesnutt 31 Dec. 1976 88 p refs
(Contract N00014-76-C-0854)
(AD-A034487; SC5076.2TR) Avail: NTIS HC A05/MF A01 CSCL 11/4

The damage to carbon-carbon composites created by projectile impacts has been characterized for a range of test conditions and for several weave constructions and processing variables. A number of subsurface damage modes have been identified (on sectioned specimens) in the vincinity of the crater produced by particulate impingement. In addition, studies are underway to determine the modes of failure which occurred in the material ejected from the crater. Preliminary analyses of the primary subsurface damage modes have been undertaken to define the approach that would elucidate the microstructural dependence of the impact damage.
Author (GRA)

N77-24204# Naval Air Development Center, Warminster, Pa. Dept. of Air Vehicle Technology.
RESEARCH ON METAL MATRIX COMPOSITES FOR NAVAL AIRCRAFT ENGINES Progress Report, 1 Nov. 1971 - 31 Oct. 1975
Marshall K. Thomas 25 Aug. 1976 65 p refs
(WR02204001)
(AD-A033724; NADC-76217-30; PR-2) Avail: NTIS HC A04/MF A01 CSCL 21/5

Directionally solidified ingots of binary titanium base eutectics with iron, cobalt, and nickel have been analyzed metallographically and tested in tension. Of these alloys, the one having a titanium matrix with 40 percent volume fraction TiFe fibers appears to have the most promising morphology. Metallographic studies of arc melted buttons of columbium base binary, ternary, and quaternary alloys indicate several eutectic alloy systems with a potential for structural applications. A study of a Cr-25Cb-34Al (wt. percent) directionally solidified alloy has verified the presence of a eutectic at the composition predicted by the computer model of Kaufman and Nesor. Preliminary weight gain oxidation tests at 2200 F indicate the Cr-25Cb-34Al eutectic in the directionally solidifed condition is superior in oxidation resistance to the carbide reinforced and directionally solidified eutectics currently being developed.
GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N77-24205 British Library Lending Div., Boston Spa (England).
METHOD AND EQUIPMENT FOR THE INTRODUCTION OF LIQUID WASTE FUELS INTO A FLUIDIZED LAYER
Pavel Novotny and Karel Hanyk Nov. 1976 6 p Transl. into ENGLISH from Czech patent no. 158913 (1975)
(BLL-RTS-10400) Avail: British Library Lending Div., Boston Spa, Engl.: £3.00; 3 BLL overseas, 3 European or 12 UK BLL photocopy coupons

A method and equipment for feeding liquid waste fuels into a fluidized layer while changing the composition of the fuel being introduced is described. The problem of self-supported combustion of different kinds of liquid flammable wastes with a minimum requirement for fitting out the equipment and with simple operation is solved. The combustion of the waste fuel takes place in a two-stage fluid burner with a relative shortage of air in such a way that the surplus of air in the fluid reactor is always less than unity, and the combustible gas leaving the fluid reactor is not burned until the second focus of combustion. Author

N77-24206 British Library Lending Div., Boston Spa (England).
INVESTIGATING THE QUALITATIVE LIBERATION OF HYDROGEN CHLORIDE IN THE CASE OF THE DECOMPOSITION OF CHLOROPRENE NATURAL RUBBER AND BURNING RUBBER BASED ON THE LATTER
P. P. Shcheglov 20 Dec. 1976 7 p refs Transl. into ENGLISH from Proiz. Sheen Rezinotekhnicheskikh Asbestotekhnicheskikh Izoelii (USSR), no. 7, 1975 p 34-35
(BLL-CE-Trans-7030-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

KRB type natural rubber and Nairit based rubber were subjected to thermal and thermo-oxidizing decomposition and combustion. Thermal decomposition was carried out in an argon medium using the thermal shock method, the material undergoing testing being placed in a reaction vessel pre-heated to a specific temperature (200-800 C). In the case of thermo-oxidizing decomposition the natural rubber was heated at a rate of 30 C/min. in a stream of air, the flow rate of which amounted to 500 ml./min. The material was heated to 900 C. The synthetic rubber was burned in a stream of air fed at a rate of 3 litres/min. at an ambient temperature of 860 C. The quantitative hydrogen chloride content in the decomposition and combustion products was 30 percent of the sample, or 85 percent of the entire chlorine contained in the natural rubber. The temperature at which hydrogen chloride liberation commences lies in the range of 220-230 C, while the main mass of hydrogen chloride is liberated at 370-380 C. No liquid breakdown products were observed. Author

N77-24207*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF A SLICING DEVICE FOR APOLLO-SOYUZ TEST PROJECT (ASTP) ELECTROPHORESIS TECHNOLOGY EXPERIMENT MA-011
B. H. Nerren Apr. 1977 18 p
(NASA-TM-X-73395) Avail: NTIS HC A02/MF A01 CSCL 07D

The electrophoresis of six columns was accomplished on the Apollo-Soyuz test Project. After separation, these columns were frozen in orbit and were returned for ground-based analyses. One major goal of the MA-011 experiment was the assessment of the separation achieved in orbit by slicing these frozen columns. The slicing of the frozen columns required a new device. The development of that device is described. Author

N77-24208*# Kanner (Leo) Associates, Redwood City, Calif.
ACTIVATION OF GAMMA-FeOOH WITH AMPHOTERIC HYDROXIDES AND ANOMALOUS BEHAVIOR OF CERTAIN COMPLEX CATALYSTS OF THIS TYPE
Alfonse Krause and Jerzy Wisniewski Washington NASA Apr. 1977 13 p refs Transl. into ENGLISH from Roczniki Chemii (Poland), v. 27, 1953, p 232-241
(Contract NASw-2790)
(NASA-TT-F-17421) Avail: NTIS HC A02/MF A01 CSCL 07D

Hydrides of copper, magnesium, aluminum, and lead were precipitated using an ammonia or NaOH solution on moist gamma-FeOOH hydrogel mixed in an aqueous salt of metal solution of the activator. After they were washed with distilled water and air dried, the mixed hydroxides were used as catalysts in the oxidation reaction of formic acid with hydrogen peroxide at temperatures ranging from 20 to 50 C. The activity of the activators was measured at 20, 37, and 50 C. Data are presented in tabular form. Author

N77-24209*# Kanner (Leo) Associates, Redwood City, Calif.
CATALYTIC ACTIVITY OF SOME HETEROGENEOUS CATALYSTS AND THEIR SURFACE AREA
Alfonse Krause and Alexsandra Binkowna Washington NASA Apr. 1977 14 p refs Transl. into ENGLISH from Roczniki Chemii (Poland), v. 31, 1957 p 801-808
(Contract NASw-2790)
(NASA-TT-F-17422) Avail: NTIS HC A02/MF A01 CSCL 07D

The adsorption, surface area and catalytic activity of various ferric hydroxides in reducing/oxidating systems were investigated. Quantitative data obtained indicates that amorphous ferric orthohydroxide occupies the first place with respect to catalytic activity. Crystalline ferric hydroxides are markedly inferior in oxidation reactions and H2O2 breakdown, although they have the largest surface among the ferric hydrates investigated. Author

N77-24210*# Scientific Translation Service, Santa Barbara, Calif.
CATALYTIC ACTION OF VARIOUS TYPES OF FERRIC HYDRATE IN THE PRESENCE OF ACTIVATORS
Ofelia Belfiori Washington NASA Apr. 1977 13 p refs Transl. into ENGLISH from Gazz. Chim. Italizna (Italy), v. 68, 1938 p 405-411
(Contract NASw-2791)
(NASA-TT-F-17423) Avail: NTIS HC A02/MF A01 CSCL 07D

The action of activators in the oxidation of H.COOH by H2O2 promoted by ferric hydrate is studied. Small amounts of copper exhibit a strong action; Mn, Ni, Co, Zn do not act in the same way. Author

N77-24211# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE THEORY OF COMBUSTION PROCESSES IN HETEROGENEOUS CONDENSED MEDIA
B. I. Khaikin 1976 23 p refs Transl. into ENGLISH from Protsessy Goreniia v Khimicheskoi Tekhnologii i Metallurgii (USSR), 1975 p 227-244
Avail: NTIS HC A03/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The combustion mechanism of mixed powders, heterogeneous systems in whose combustion zone gasification of the substance occurs because of chemical reactions or phase transitions, was studied. Specific topics discussed include: (1) combustion of an ordered laminar system; (2) deductions for real heterogeneous systems; (3) stationary propagation of the combustion zone; (4) melting components and reaction products; and (5) stability of the stationary combustion mode, self-oscillating combustion, and combustion limits. A theoretical analysis is presented.J.M.S.

N77-24212# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF RADIATION ON THE PRESSURE DEPENDENCE OF THE UPPER LIMIT OF LUMINOUS FLAME PROPAGATION
E. A. Granovskii, V. N. Gudkovich, and B. G. Piskunov 26 Dec. 1974 6 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), v. 13, no. 1, 1977 p 67-71
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The pressure dependence of radiation heat loss in sooty flames was investigate using a vertical tube connected at the upper end to a nitrogen filled tank. Propylene-oxygen mixtures

were prepared under high pressure and agitated electromagnetically. The composition obtained was checked by selecting samples from the mixer and the tube and a subsequent analysis with a + or -0.1% accuracy on a VTI-2. The mixture was ignited by a hot wire at the upper end of the tube which was open during flame propagation. An analytic expression is obtained for the limit pressure of flame propagation in a mixture of definite composition. Author

N77-24213# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE MECHANISM OF ELECTRODE REACTIONS OF HYDROGEN PEROXIDE ON CARBON MATERIALS IN NEUTRAL ELECTROLYTES
A. I. Anurova, E. V. Bairachnyi, and T. I. Barkova 1977 5 p refs Transl. into ENGLISH from Elektrokhimiya (USSR), v. 13, no. 1, 1977 p 54-58
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The mechanism of electrode reactions of hydrogen peroxide on carbon and pyrographite electrodes in aqueous solutions of sodium sulfate is investigated. The fundamental parameters of the electrochemical kinetics of the electroreduction and electrooxidation reactions of hydrogen peroxide are determined, and representations are expressed about the stage mechanism of these reactions with retarded stages of the transition of the first electron. Author

N77-24214# California Univ., Livermore. Lawrence Livermore Lab.
EBF1: A COMPUTER SIMULATION OF THE PREBURST BEHAVIOR OF ELECTRICALLY HEATED EXPLODING FOILS
J. D. Logan (Kansas State Univ.) and R. S. Lee (Kansas State Univ.) Jun. 1976 31 p refs
(Contract W-7405-eng-48)
(UCRL-52003) Avail: NTIS HC A03/MF A01

A computer code is presented for calculating the transient temperature and current distributions in electrically exploded foils. The model is applicable up until the time of burst. Calculations presented for aluminum, copper, and gold foils show good agreement with experimental current waveforms and burst times over a wide range of capacitor bank charging voltages and for varying foil cross sections. The two dimensional nature of the calculation permits investigation of effects associated with nonuniform heating of the foil and gives an estimate of the simultaneity of burst. ERA

N77-24215# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A SPARK INSENSITIVE ACTUATOR/IGNITER
Edwin A. Kjeldgaard Sep. 1976 27 p refs Presented at the 5th Intern. Pyrotechnic Seminar, 12-16 Jul. 1976
(Contract E(29-1)-789)
(SAND-76-0508) Avail: NTIS HC A03/MF A01

The development of a new, spark insensitive pyrotechnic material, TiH/sub x//KClO4, for actuators and igniters is discussed. The parametric investigation of the material is primarily aimed at answering the question: can a pyrotechnic be sensitive to hot wire ignition, yet insensitive to ignition from a spark generated by a human body? A number of variables were studied, among which are the following: hydrogen and oxygen content, surface area and particle size, powder density at the bridgewire, component hardware configuration, ignition energy, and calorific output. The results of the investigation answered the question posed above in the affirmative. Spark sensitivity was found to be a function of hydrogen content and surface area, while bridgewire ignition sensitivity and reliability were primarily determined by the powder density at the bridgewire. ERA

N77-24216# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
LASER FLUORESCENCE SPECTROSCOPIC INVESTIGATIONS OF THE (A 1 SIGMA(+)=X 1 SIGMA(+)) SYSTEM OF 7LiD Ph.D. Thesis - Goettingen Univ., West Ger. [LASERFLUORESZENZSPEKTROSKOPISCHE UNTERSUCHUNGEN AN DEM (A 1 SIGMA(+) - X 1 SIGMA(+))-SYTEM VON 7LiD]
Guenther Ennen Sep. 1976 133 p refs In GERMAN
(MPIS-15/1976) Avail: NTIS HC A07/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 22.50

The laser fluorescence spectroscopy method was used to investigate the 7LiD molecule. The wavelengths and intensities of the fluorescence series were measured. New molecular constants for the X-state were determined from the wavelengths, and improved constants for the A-state were obtained from available data and a fit. Several methods for determining potential curves from molecular constants are discussed and applied to the new constants. The fluorescence line intensities were used to determine the transition probabilities. ESA

N77-24217# European Space Agency, Paris (France).
COHERENT ANTI-STOKES RAMAN SCATTERING NEAR ELECTRONIC RESONANCES AND FABRICATION OF AN EXPERIMENTAL SET-UP
Sylvie Druet Apr. 1977 120 p refs Transl. into ENGLISH of 'Diffusion Raman Anti-Stokes Coherente au Voisinage des Resonances Electroniques et Realisation d'un Montage Exptl. 'ONERA, Paris Report ONERA-NT-1976-6, 1976 Original report in FRENCH previously announced as ESA-98560
(ESA-TT-371; ONERA-NT-1976-6) Avail: NTIS HC A06/MF A01

The application of spectroscopy to gas by coherent anti-Stokes Raman scattering (CARS) is discussed. The characteristic features of CARS are reviewed along with the latest achievements. The use of electronic resonances is then sought for improving the detectivity of this method. Different cases of resonant excitation can be inferred from the quantum mechanical expression of the susceptibility. In each case, the difficulties associated with resonant CARS are pointed out, and detectivity improvement is estimated from resonant spontaneous Raman scattering data. The experiment set up incorporating two tunable dye lasers is described. Author (ESA)

N77-24218# Little (Arthur D.), Inc., Cambridge, Mass.
CHRIS/HACS CHEMICAL PROPERTY FILE
E. Atkinson Dec. 1976 905 p
(Contract DOT-CG-24655-A)
(AD-A034607; USCG-D-124-76) Avail: NTIS HC A99/MF A01 CSCL 07/2

This report represents a listing of the Chemical Properties File which is an integral part of the Hazard Assessment Computer System (HACS). This file contains the physical and chemical properties of some 900 chemical substances; as many as 74 properties may be recorded for each chemical. The properties contained in the file may be either exact values from the chemical literature or estimated values obtained by the use of standard estimation techniques. An '(E)' following a value indicates it is an estimated value; all others are exact. The properties, their code names and their ordering on the file are given at the beginning of this report. All numeric data are listed in SI units. GRA

N77-24219# New York Univ., N. Y. Dept. of Chemistry.
PHOTOELECTRON SPECTROSCOPY OF LIQUIDS UP TO 21.2 eV
Ladislav Nemec, Hans Jasper Gaehrs, Lucille Chia, and Paul Delahay Dec. 1976 38 p refs
(Contract N00014-75-C-0397)
(AD-A034860; TR-5) Avail: NTIS HC A03/MF A01 CSCL 20/8

Photoelectron spectroscopy of liquids is investigated at variable photon energy up to 10 eV and with rare-gas resonance lines at 11.7 (ArI), 16.8 (NeI), and 21.2 (HeI) eV. Seven liquids are studied: N-methylaniline, N,N'-dimethyl-p-toluidine, formamide, hexamethyl phosphoric triamide, tetraglyme, ethylene glycol, and n-decanol. Energy distribution curves display at the higher photon energies a band structure matching the sequence of bands in the corresponding gas-phase photoelectron spectra. The bands are attributed to emission of unscattered electrons (no loss of kinetic energy to the liquid), whereas the underlying background is ascribed to scattered (in the liquid) electrons. Quantitative treatment based on this interpretation agrees with experiment. Energies characterizing either bulk or surface photoionization are determined within + or - 0.1 eV. The gas-liquid red shift (0.9 to 1.4 eV) and bulk-surface blue shift (0.5 to 1.3 eV) in photoionization energies are interpreted in terms of electronic

polarization of the liquid medium. This is, to our knowledge, the first investigation of liquids by ultraviolet photoelectron spectroscopy above 10 eV. Author (GRA)

N77-24220# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
DETERMINATION OF CONTAMINANTS IN LESS-FLAMMABLE HYDRAULIC FLUIDS Final Report
Robert G. Jamison Sep. 1976 22 p
(AD-A034751; MERADCOM-2192; F-662611-AH69) Avail: NTIS HC A02/MF A01 CSCL 11/8

The introduction of a new, less-flammable, synthetic-base hydraulic fluid (MIL-H-46170) for armored vehicles operating in hostile environment created a problem in the operability of the M60 A1 (AOS) hydraulic and gun-control system. In the determining of problem origin, a need was created for methodology to (1) determine the level of MIL-H-6083 petroleum-base hydraulic fluid remaining in the system after retro-fit, and (2) determine the amount of adsorbed water. Gas-liquid chromatographic procedures were subsequently developed to accomplish these objectives. Author (GRA)

N77-24221# R and D Associates, Marina Del Rey, Calif.
MIXING AND COMBUSTION MECHANISMS IN HIGH-SPEED FLOWS Final Report, 1 Apr. 1975 - Nov. 1976
R. B. Edelman and P. T. Harsha 1976 13 p refs
(Contract F44620-75-C-0065; AF Proj. 9711)
(AD-A033619; AFOSR-76-1186TR) Avail: NTIS HC A02/MF A01 CSCL 21/2

A modular model for the analysis of turbulent reacting flows in dump combustors has been formulated and preliminary calculations have been carried out. The methodology involves coupling a stirred reactor model for the recirculation zone(s) to a parabolic mixing model for the directed flow outside of the recirculation zones. This modular model includes the finite-rate formulations of Edelman and the turbulent kinetic energy turbulence models of Harsha. Elements of the model have been compared with available experimental data and other predictions. The results of the comparison have shown that the model is capable of accurate predictions of turbulent reacting flows. Additional work has included the submission of a series of recommended tests to WPAFB/AFAPL. These tests are designed to get data of direct practical use as well as data needed for model development. Steady-state combustion performance and flame stabilization as functions of fuel type, injector location and type, direct injection into the base recirculation zone, and inlet flow state are included. Measurements include pressures, temperatures, flow rates, concentrations, and thrust as well as direct observation of flame blowout (stabilization). Finally, recommendations for future work have been defined. These include further development of the modular model and the initiation of a unified model. In addition, it is recommended that consideration be given to the impact that the use of alternate (non-petroleum) fuels will have on the combustion characteristics of advanced combustor concepts. Author (GRA)

N77-24222# Aeronautical Research Associates of Princeton, Inc., N. J.
A PRELIMINARY INVESTIGATION OF VELOCITY-COUPLED EROSIVE BURNING Interim Report, 1 Oct. 1975 - 30 Sep. 1976
Robert A. Beddini, Ashok K. Varma, and E. Stokes Fishburne Nov. 1976 25 p ref
(Contract F44620-76-C-0016; AF Proj. 6813)
(AD-A032895; ARAP-290; AFOSR-TR-76-1252) Avail: NTIS HC A02/MF A01 CSCL 21/2

Some aspects of the velocity-coupled erosive burning of solid propellants have been examined. The turbulent flowfield is shown to be an important aspect of the overall problem, and is modeled using an extension of the second-order closure scheme originally developed by Donaldson. A simple preliminary flame model -- that of homogeneously mixed reactants proceeding through a single step reaction -- has been coupled to the surface recession mechanism used by Summerfield. Results for varying core velocity indicate an apparent threshold, above which erosive burning occurs. This threshold velocity is coincident with the turbulence layer descending to a position just inside the flame zone. An appreciable increase in burning rate was observed with the presence of a relatively small turbulence level in the flame zone. The erosion ratio, as a function of core velocity, is qualitatively similar to classical descriptions. The results indicate that quantitative agreement with experimental erosive burning rates may be possible with the implementation of propellant combustion mechanisms at a level consistent with the turbulence closure approach. GRA

N77-24223# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ION IMPLANTATION IMPURITY ANALYSIS BY GLOW DISCHARGE OPTICAL SPECTROSCOPY M.S. Thesis
David S. Hake Dec. 1976 85 p refs
(AD-A034007; GEP/PH/76D-5) Avail: NTIS HC A05/MF A01 CSCL 20/12

The Glow Discharge Optical Spectroscopy technique was investigated to determine if it could be used to measure total impurity concentration profiles in unannealed ion implanted GaAs. Cadmium, zinc, and magnesium ions, which are common p-type dopants in GaAs, were implanted at energies of 99 keV and 120 keV and fluences ranging from 10 to the 14th power to 10 to the 16th power ions/sq cm. The implanted GaAs samples were sputtered in a low pressure dc glow discharge using argon gas. Intensity of a strong emission line, characteristic of the implanted impurity, was monitored as a function of time. This intensity was combined with independently measuring GaAs substrate sputtering rates to calculate total impurity concentration profiles. Uncalibrated concentration profiles were obtained for Zn and Mg in GaAs. None was obtained for Cd. Author (GRA)

N77-24224# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
IGNITION OF A REACTIVE MATERIAL BY HOT GASES
M. Kindelan 15 Nov. 1976 18 p refs
(Grant AF-AFOSR-2535-73; AF Proj. 6813; AF Proj. 9711)
(AD-A034858; SR-2; AFOSR-77-0004TR) Avail: NTIS HC A02/MF A01 CSCL 21/2

An asymptotic analysis is developed, describing ignition of a reactive solid suddenly exposed to hot gases. It is found that in the limit of high activation energy of the Arrhenius exothermic reaction, the chemical heat release occurs in a thin diffusive-reactive layer near the surface. The solution for this inner layer is then matched to the solution for the outer transient-diffusive region. An explicit formula for the ignition time is obtained. GRA

N77-24225# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
GASIFICATION EFFECTS IN THE HETEROGENEOUS IGNITION OF A CONDENSED FUEL BY A HOT GAS
M. Kindelan and A. Linan 8 Nov. 1976 29 p refs Sponsored in part by European Office of Aerospace Res. and Develop., London, Engl.
(Grant AF-AFOSR-2535-73; AF Proj. 6813; AF Proj. 9711)
(AD-A034859; SR-1; AFOSR-77-0002TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

An analysis is presented to describe the heterogeneous ignition of a condensed fuel suddenly exposed to a hot oxidizing atmosphere. The exothermic heterogeneous reaction, generating gaseous products, is considered to be of the Arrhenius type with an activation energy large compared with the initial thermal energy of the fuel. Instantaneously after a contact with the gases the surface temperature rises to a jump value which is calculated allowing for variable transport properties of fuel and gas. The effect of the chemical heat release and the cooling effect due to the gasification flow are taken into account in obtaining an integral equation, involving a single parameter delta, which is solved to describe the evolution of surface temperature with time. A runaway in surface temperature is found to occur at a well defined ignition time, which is calculated as a function of delta. For values of delta above a critical value no ignition occurs because the cooling effects of the gasification flow dominate over the effects of chemical heat release. GRA

N77-24226# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
COMBUSTION AND FLAME PROPAGATION IN HETEROGENEOUS SYSTEMS Final Report, 1 Jun. 1972 - 30 Jun. 1976

Antonio Crespo 29 Oct. 1976 25 p refs
(Grant AF-AFOSR-2253-72)
(AD-A033936; AFOSR-76-1420TR) Avail: NTIS HC A02/MF A01 CSCL 21/8

This report first summarizes the works carried out on unsteady effects in droplet evaporation and combustion and on the behaviour of hydrazine catalytic thrusters working under steady state conditions. A topic that is presented in more detail, is on the influence of the temperatures of liquid hydrazine and catalyst particle temperatures on the vacuum start characteristics of a reactor. The model used assumes the existence of a liquid front that first advances towards the interior of the catalyst particle by porous action and then recedes towards the exterior. An order of magnitude estimate seems to indicate that during the process, convective heat transfer dominates over conduction, and the analysis shows the existence of a thin thermal front, whose structure is calculated. Then, the liquid penetration is only governed by the initial particle temperature. For low enough initial particle temperatures the thermal front structure reaches the liquid front and the liquid penetration is also influenced by the initial hydrazine temperature. GRA

N77-24227# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.
MOLECULAR STUDIES OF GASEOUS OXIDES Final Report, 1 Jul. 1975 - 30 Sep. 1976
Edmond Murad and Y. Tanaka 20 Sep. 1976 20 p refs
(AF Proj. 6690)
(AD-A033675; AFGL-TR-76-0213; AFGL-ERP-577) Avail: NTIS HC A02/MF A01 CSCL 07/4

A surplus high temperature mass spectrometer has been successfully refurbished and put into operation. Preliminary measurements of the dissociation energy of gaseous praeseodymium monoxides gave the value of 175.9 plus or minus 3 kcal/mol (or 7.65 plus or minus 0.13 eV). Final analysis of the results on the dissociation energy of gaseous europium monoxide gave the value of 111.9 plus or minus 2.4 kcal/mol (or 4.85 plus or minus 0.10 eV). Preliminary measurements on the vacuum ultraviolet spectra of molecules formed with mixtures of argon-oxygen and of krypton-oxygen have been performed. In the case of Kr - O2 five continua with peaks at 1490A, 1830A, 2090A, 2320A, and 2520A, are observed. Author (GRA)

N77-24228# National Bureau of Standards, Washington, D. C. Chemical Kinetics Information Center.
CHEMICAL KINETICS OF THE GAS PHASE COMBUSTION OF FUELS (A BIBLIOGRAPHY ON THE RATES AND MECHANISMS OF OXIDATION OF ALIPHATIC C1 TO C10 HYDROCARBONS AND OF THEIR OXYGENATED DERIVATIVES) Final Report, 1902-1975
Francis Westley Oct. 1976 142 p refs
(Contract E(49-1)-3800)
(PB-263122/4; NBS-SP-449; LC-76-608282) Avail: NTIS HC A07/MF A01 CSCL 07D

Rate data for gas phase reactions of combustion and oxidation of aliphatic saturated or unsaturated C1 to C10 hydrocarbons, alcohols, aldehydes, ketones, ethers, peroxides and their free radicals are presented. Decomposition, disproportionation, atom transfer, and recombination reactions of the oxygen containing species noted above are also discussed. GRA

N77-24229# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.
ELECTROCATALYSIS ON NON-METALLIC SURFACES Final Report
A. D. Franklin, ed. Nov. 1976 367 p refs Workshop held at Gaithersburg, Md., 9-12 Dec. 1975 Sponsored in part by NSF and ERDA
(PB-262886/5; NBS-SP-455; LC-76-600062) Avail: NTIS HC A16/MF A01 CSCL 07D

The most recent experimental and theoretical investigations on electrocatalysis on non-metals and related topics were reviewed. The theory of electrocatalysis and related topics; electrochemical processes on non-metallic surfaces; and electrochemistry at solid electrolyte interfaces were some of the topics covered. GRA

N77-24230# Pittsburgh Univ., Pa.
STUDIES ON A MECHANISM FOR SALT REJECTION IN REVERSE OSMOSIS MEMBRANES AS A GUIDE TO IMPROVED MATERIALS FOR DESALINATION OF SEA WATER Final Report, 1 Dec. 1973 - 30 Nov. 1976
1976 82 p refs
(Contract DI-14-30-3241)
(PB-262410/4; OWRT/S-77/2; W77-03290) Avail: NTIS HC A05/MF A01

Studies of the interactions of ions with water in nonaqueous systems are presented in general, and in reverse osmosis membranes in particular. Cellulose acetate membranes which were treated with aqueous salt solutions were studied. The membranes were observed by ESCA (Electron Spectroscopy for Chemical Analysis) and by Flame Emission Spectroscopy. It is shown that sodium ions penetrate and are retained in the membranes, even after rinsing, and that their interaction appears to be particularly strong in the active side of the asymmetrical membranes. GRA

N77-24231# California Univ., Davis. Dept. of Chemistry.
HIGH ENERGY CHEMICAL REACTIVITY Final Technical Report, 15 Oct. 1972 - 31 Dec. 1975
John W. Root 1976 11 p refs
(Grant AF-AFOSR-2460-73; AF Proj. 9538)
(AD-A033995; AFOSR-76-1416TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

Gas-liquid critical constants have been measured for fluorinated ethanes and used to test empirical corresponding states relations for the determination of molecular force constants. These empirical relations appear to be applicable to essentially all substances for which critical data are available. A radio-tracer technique has been developed for the investigation of unimolecular collisional energy transfer for 14CH3CF3 activated by 14CH3 plus CF3 recombination. This method has yielded a significant improvement in sensitivity with respect to existing techniques. It appears to be widely applicable for high accuracy studies of unimolecular reactions. GRA

N77-24232# Texas Univ., Austin. Dept. of Chemistry.
THERMAL DECOMPOSITION OF METHANOL ADSORBED ON MAGNESIA Interim Report, 1 Sep. 1975 - 1 Jan. 1977
David C. Foyt and J. M. White 1 Jan. 1977 31 p refs
(Contract N00014-75-C-0922)
(AD-A034793) Avail: NTIS HC A03/MF A01 CSCL 07/3

The thermal desorption of methanol and its decomposition products from magnesium oxide powder were recorded over the temperature range 300-1123 K. The formation of formaldehyde was observed in small quantities above 438 K. Large quantities of CO and H2 were evolved at 723-900 K, accompanied by smaller amounts of CH4. No ether formation was detected. Methanol desorption was observed below 773 K, with structure in the spectrum revealing at least two different phases of the desorption process. The variation of this structure with initial coverage serves to confirm and clarify previous models for methoxyl on MgO, based on infrared absorption studies.
Author (GRA)

N77-24233# Cambridge Univ. (England). Dept. of Physical Chemistry.
THE REACTION OF OXYGEN ATOMS WITH NITRATES Final Technical Report, 30 Mar. 1975 - 8 Nov. 1976
B. A. Thrush and L. F. Salter 8 Nov. 1976 23 p refs
(Grant DA-ERO-75-G-020; DA Proj. 1T1-61102-B-13B)
(AD-A033835) Avail: NTIS HC A02/MF A01 CSCL 07/3

The reaction of oxygen atoms with methyl nitrate and with ethyl nitrate have been studied in a discharge-flow system at temperatures between 294 and 473 K. The initial attack involves abstraction of a hydrogene atom. The activation energy for hydrogen abstraction is not reduced by the fact that the initally formed radical ruptures exothermically to yield aldehyde plus nitrogen dioxide. The reaction mechanism and its relation to alkyl nitrate pyrolyses are discussed briefly. GRA

N77-24234# Chicago Univ., Ill. James Franck Inst.
EXPERIMENTAL AND THEORETICAL STUDIES IN PHOTOCHEMISTRY Final Report, 1 Sep. 1972 - 31 Aug. 1976

Stuart A. Rice Sep. 1976 28 p refs
(Contract F44620-73-C-0005)
(AD-A034065; AFOSR-76-1415TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

The results of four years of research on elementary photophysical and photochemical processes are discussed. Particular attention is paid to intramolecular vibrational relaxation, radiationless processes, the coupling of molecular geometry changes to photochemical reactions and laser induced photochemistry.
Author (GRA)

N77-24235# Southwest Research Inst., San Antonio, Tex.
ENCAPSULATION OF CHEMILUMINESCENT MATERIALS Final Report, 1 May 1975 - 31 Oct. 1976
Leon M. Adams and Chel W. Lew Dec. 1976 34 p refs
(Contract N00014-75-C-0997)
(AD-A033922) Avail: NTIS HC A03/MF A01 CSCL 07/4

A stable capsule containing Oxalume has been developed using a mixture of paraffin wax and an ethylene-vinyl acetate copolymer as the shell material. Dusting the capsules with either finely powdered sodium acetate or poly(vinyl alcohol) activates the capsules so that the Oxalume will chemiluminesce when the capsules are crushed. The sodium acetate is the more potent activator, but the poly(vinyl alcohol) produces a more stable system.
Author (GRA)

N77-24236# Texas Univ., Austin. Dept. of Chemistry.
EXPERIMENTAL AND THEORETICAL STUDIES OF ELECTRON BINDING ENERGIES OF WATER ADSORBED ON ALPHA-ALUMINA Interim Report, 1 May 1975 - 1 Dec. 1976
D. B. Almy, D. C. Foyt, and J. M. White 1 Dec. 1976 22 p refs Submitted for publication
(Contract N00014-75-C-0922)
(AD-A033961) Avail: NTIS HC A02/MF A01 CSCL 07/4

Ultraviolet photoelectron spectra (HeI radiation) have been obtained for a partially hydroxylated surface of single crystal alpha-alumina (0001) and for water chemisorbed on this surface at 298 K. Model calculations using the SCF-X alpha-Sw method have also been performed, and, with their aid, the features of the partially hydroxylated spectra have been assigned. Spectral features associated with additional hydration at 298 K are consistent with the adsorption of strongly bound molecular water.
Author (GRA)

N77-24237# Environmental Protection Agency, Cincinnati, Ohio.
ANALYTICAL METHODS FOR TRACE METALS
Jack Pfaff Jan. 1976 76 p
(PB-263560/5; EPA-430/1-76-002) Avail: NTIS HC A05/MF A01 CSCL 14B

This manual is designed as a course for chemists or technicians of industrial or municipal treatment plants who are required to perform analysis for trace metals. Participants learn theoretical concepts and perform a variety of laboratory determinations. Topics include metal analysis by atomic absorption, flame photometry, and volumetric and colorimetric procedures. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-24238 British Library Lending Div., Boston Spa (England).
CORROSION OF BOUNDARY ALLOYS OF LEAD IN A SULPHURIC ACID SOLUTION
V. I. Bryntseva, L. A. Tskhe, V. G. Bundzhe, Yu. D. Dunaev, and D. Z. Kiryakov Mar. 1977 30 p refs Transl. into ENGLISH from Tr. Inst. Khim. Nauk, Akad. Nauk Kaz. SSR (USSR), v. 21, 1969 p 3-22
(BLL-RTS-9751) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

The electrochemical behavior of binary systems of lead with silver, antimony, bismuth, and thallium was investigated and compared. It is shown that the corrosion resistance of lead alloys is directly related to the resistance of the components in the medium concerned. In the case of anode polarization, both the structural factor, and the electrochemical-catalytic action of metals and their compounds on the electrode process must be included in calculating corrosion resistance.
Author

N77-24239 British Library Lending Div., Boston Spa (England).
ANODIC BEHAVIOUR OF LEAD-BASED AND OTHER METALLIC ALLOYS IN AQUEOUS SOLUTIONS
Yu D. Dunaev Mar. 1977 16 p refs Transl. into ENGLISH from Kataliticheskie Reaktsii v Zhidkoi Faze: Tr. 2 Uses. Konf. Alma - Ata, 1967 p 388-394
(BLL-RTS-9792) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The stability of various metals, their alloys, and combinations, used in anodic processes, under drastic oxidation conditions is considered. Polarization curves for titanium, tantalum, and iron, the electrochemical properties of these metals after coating with a platinum, layer, and relationships in the change in stability of lead as a result of alloying are among the factors discussed. It is concluded that elements having catalytic properties have an effect on the electrochemical behavior of the anode and its stability, independently of whether they exist in the composition of the alloy, as powder systems in the form of coatings, or as ions in solution. Thus, it is possible to prepare anode systems with a definite range of catalytic and electrochemical properties. J.M.S.

N77-24240 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF THE PASSIVATING ACTION OF CHROMATE PIGMENTS ON IRON
N. I. Savitskaya et al Apr. 1977 10 p Transl. into ENGLISH from Lakokroscoch. Mater. Ikh Primen. (USSR), no. 1, 1972 p 31-33
(BLL-RTS-10571) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The action of chromate pigments on steel was investigated. The passivating ability of the pigments from the shift in the stationary potential of the steel in aqueous extracts was estimated, and a change in the rate of corrosion was determined gravimetrically. Anodic polarization curves characteristing the behavior of iron in buffer solutions in also shown. It was established that the anodic behavior of iron in extracts of chromate pigments is wholly determined by the action of the CrO4(-2) anion which ensures passivation of iron at a concentration of 0.0003 M. It was shown that the passivation of iron does not depend on the nature of the cation present in the pigment.
Author

N77-24241 British Library Lending Div., Boston Spa (England).
OXIDATION OF COPPER AND THE SOLUBILITY OF OXYGEN IN THE METAL
F. Bouillon, G. VanDerSchrick, and C. Kaeckenbeeck-VanDerSchrick Apr. 1977 12 p refs Transl. into ENGLISH from Acta Met., v. 10, no. 7, 1962 p 647-652
(BLL-RTS-10580) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The results of isothermal oxidation were interpreted by taking into account two distinct and conflicting effects: the formation of the oxide at the surface and its dissolution in the metal. Their relative importance was evaluated by comparing the results obtained by gravimetry with those obtained by electrochemical reduction. The effect is practically zero at temperatures below 250 C where the solubility of the oxygen is negligible. The difference between the amounts of oxide present at the surface and the amounts corresponding to the oxygen consumed becomes pronounced at higher temperatures (above 500 C).
Author

N77-24242 British Library Lending Div., Boston Spa (England).
PRACTICAL RESULTS OF CHEMICAL PLANTING WITH AMINOBORANE BATHS
W. Frick Apr. 1977 13 p refs Transl. into ENGLISH from Galvanotechnik (Saaulgau, W. Ger.), v. 67, no. 9, 1976 p 730-734
(BLL-RTS-10606) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Phosphorous-free nickel deposits on metals are obtained using

sodium boranate at plating rates of 20 to 30 micron/h and to virtually any coating thickness. These nickel deposits have excellent hardness after deposition, a capacity for hardening by subsequent heat treatment, a good corrosion resistance, abrasion resistance, and good sliding capacity. The boron hydride baths must be operated at temperatures of 90-95 C, and the pH value must not descend below 12. Reducing agents suitable for chemical metal plating and their application conditions are given in tables. A.R.H.

N77-24243 British Library Lending Div., Boston Spa (England).
METHODS FOR CYCLICAL STRENGTH TESTING OF REFRACTORY METALS IN A VACUUM AT HIGH TEMPERATURES
M. G. Velmakin, A. M. Melnik, and G. F. Sinitsyn Jan. 1977 6 p refs Transl. into ENGLISH from Svetotekhnika (USSR), v. 5, 1973 p 14-15
(BLL-RTS-10482) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The magnetic field of a solenoid is used for loading test pieces in a vacuum apparatus designed for determining the fatigue strength of tungsten wire at high temperatures. Provision is made for different forms of tensile testing: static, alternating, and static with cyclic superposed. The magnitude of the load is determined by the value of the solenoid current. Author

N77-24244 British Library Lending Div., Boston Spa (England).
THEORY AND TECHNIQUE OF LACQUERING ALUMINUM FOIL
J. Bastide [1976] 8 p Transl. into ENGLISH from Papiers, Cartons, Complexes (France), 15 Jun. 1970 p 13-16
(BLL-M-24829-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Lacquers used to coat aluminum are classed as colorless and non-weldable, colored, and thermosetting. The properties of each class of products are described and methods for their application discussed. The techniques include coating baths, continuous coloring on the counter-sizing by flexography or photogravure, and the thermosticking of dry lacquer film. A.R.H.

N77-24245 British Library Lending Div., Boston Spa (England).
ECONOMICS AND ORGANIZATION OF METALLURGICAL PRODUCTION: EFFECTIVENESS OF THE USE OF MAGNETIC FIELDS IN MELTING ALLOY STEELS
I. I. Ivanov, L. F. Vorobeva, and G. V. Bergauz [1976] 7 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 5, 1976 p 183-185
(BLL-M-25473-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The technical and economic effectiveness of using a magnetic field from a solenoid for remelting alloy steels in a water-cooled mold beneath a layer of flux was investigated. When ball bearing, structural, stainless, and heat resistant steels are remelted in a magnetic field the quality of the metal is improved. Heat duration is reduced by 1.0-1.3 h, the specific electric power consumption is reduced 15-20%, and furnace delivery is raised by 18-25%. The reduction in the cost of ingots is, depending on the grade of steel, 1.6-4.0%, while the specific capital outlay on the remelting plant is reduced by 15-20%. Author

N77-24246 British Library Lending Div., Boston Spa (England).
METAL PHYSICS: FORMATION AND STRUCTURE OF SIMPLE METALLIC LIQUIDS ON THE BASIS OF ELECTRON-IC-IONIC INTERACTION
E. S. Filippov [1976] 25 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 5, 1976 p 137-144
(BLL-M-25471-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Heat content, sublimation energy, and ionization and Fermi energy are calculated at the boiling point for 15 single and multiple valence metals using the nonadjustable potential of interaction between the valence electrons and the ion nucleus. At the boiling point, the atoms of liquid are statistically packed, there is no degree of aggregation, and interaction is limited to the closest 6.5-4.5 neighbors. The electrons are excited to a state where all the free volume may be occupied. Therefore, at the boiling point, a liquid can be taken at a zero approximation similar to an ideal gas for gases. Author

N77-24247 British Library Lending Div., Boston Spa (England).
SURFACE TEMPERATURE OF THE METAL DURING A PLASMA MELT
A. V. Laktionov, A. Ya. Stomakhin, and V. A. Grigoryan [1976] 7 p refs Transl. into ENGLISH from Izv. VUZ Chernaya Met. (USSR), v. 5, 1976 p 72-77
(BLL-M-25468-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Brilliance pyrometry is used to study the temperature field on the surface of the molten iron in the plasma arc zone in laboratory conditions by filming the b bath the moment the current is switched off. The temperature measurement error was found to be no greater than 60 degrees. Increasing the argon flow rate raised the maximum metal surface temperature from 1950 to 2050 C in the arc zone. Adding 9.1 percent nitrogen to the argon was accompanied by an increase in electric power from 3.24 to 3.60 kW and raised the maximum temperature from 1970 to 2050 C. A further increase in the nitrogen content of the gas from up to 21.6 to 30 percent raised the maximum temperature from up to 2150 to 2250 C without any further change in power. Author

N77-24248 British Library Lending Div., Boston Spa (England).
EFFECTS OF TEMPERATURE, AND OF PLASTIC DEFORMATION, ON THE GAMMA YIELDS ALPHA TRANSFORMATION IN O3Kh13AG19 STEEL AND ITS MECHANICAL PROPERTIES
E. T. Shinkarenko, V. G. Khoroshailov, G. N. Grikurov, N. P. Antropov, and I. S. Demchuk [1976] 7 p refs Transl. into ENGLISH from Izv. VUZ (USSR), v. 8, 1976 p 105-106
(BLL-M-25505-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The gamma yields alpha transformation and mechanical properties of 03Kh13AG19 steel were investigated with relation to test temperature and the degree of plastic deformation. The extent of the transformation increases as the degree of plastic deformation is increased, and as the temperature is lowered from +20 to -196 C. The mechanical properties were determined at +20, -78, -196, and -253 C. Author

N77-24249 British Library Lending Div., Boston Spa (England).
CONTRIBUTION TO THE THEORY OF RAPID HEATING AND RAPID COOLING OF STEEL
H. Schlicht 26 Nov. 1976 26 p refs Transl. into ENGLISH from Haeterei Tech. Mitt. (West Ger.), v. 29, no. 3, 1974 p 184-192
(BLL-OA-Trans-1554-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

The effect on steel of rapid heating by brief action of laser or electron beams, by electrical energy, by plastic deformation of the crystal lattice, and of high hydrostatic pressures and elastic and plastic strains of the crystal lattice is discussed. The influence on the phase equilibria and phase transformations and on solution and precipitation processes is emphasized. The properties of the rapidly heat treated and cooled structures are described. Author

N77-24250*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIFFUSION WELDING OF A DIRECTIONALLY SOLIDIFIED GAMMA/GAMMA PRIME - DELTA EUTECTIC ALLOY
Thomas J. Moore May 1977 12 p refs
(NASA-TM-X-3514; E-8755) Avail: NTIS HC A02/MF A01 CSCL 11F

Hot-press diffusion welding parameters were developed for a directionally solidified, gamma/gamma prime-delta eutectic alloy. Based on metallography, a good diffusion weld was achieved at 1100 C under 34.5 MPa (5 ksi) pressure for 1 hour. In addition, a dissimilar metal weld between gamma/gamma prime-delta and IN-100 was successfully made at 1100 C under 20.7 MPa (3 ksi) pressure for 1 hour. Author

N77-24251# Council for Scientific and Industrial Research, Pretoria (South Africa).
A CONTRIBUTION TO THE STUDY OF THE IMPROVEMENT OF ABRASION-RESISTANT AUSTENITIC MANGANESE STEEL

F. J. Maratray and T. E. Norman 1976 45 p refs Transl. into ENGLISH from Rev. Met. (Paris), v. 58, 1961 p 489-506 (CSIR-Trans-1323) Avail: NTIS HC A03/MF A01

The life expectancy of cones of rotating mills made of 12Mn-2Mo steel with dispersed carbides was shown superior by 50% to that of classic Hadfield steel. Higher carbon content increases its life expectancy further. Steels with low manganese content stabilized with molybdenum, 6Mn-1Mo were also used as gouging abrasion resistant when the intensity of the shocks was not very high. As regards grinding abrasion, these types of steel have an abrasion resistance comparable to that of Ni-Hard white iron. Author

N77-24252*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CREEP AND TENSILE PROPERTIES OF SEVERAL OXIDE-DISPERSION-STRENGTHENED NICKEL-BASE ALLOYS AT 1365 K

J. Daniel Wittenberger Washington May 1977 24 p refs (NASA-TN-D-8422; E-8882) Avail: NTIS HC A02/MF A01 CSCL 11F

The tensile properties at room temperature and at 1365 K and the tensile creep properties at low strain rates at 1365 K were measured for several oxide-dispersion-strengthened (ODS) alloys. The alloys examined included ODS Ni, ODS Ni-20Cr, and ODS Ni-16Cr-Al. Metallography of creep tested, large grain size ODS alloys indicated that creep of these alloys is an inhomogeneous process. All alloys appear to possess a threshold stress for creep. This threshold stress is believed to be associated with diffusional creep in the large grain size ODS alloys and normal dislocation motion in perfect single crystal (without transverse low angle boundaries) ODS alloys. Threshold stresses for large grain size ODS Ni-20Cr and Ni-16Cr-Al type alloys are dependent on the grain aspect ratio. Because of the deleterious effect of prior creep on room temperature mechanical properties of large grain size ODS alloys, it is speculated that the threshold stress may be the design limiting creep strength property. Author

N77-24253*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF SIMULATED EARTH REENTRY EXPOSURE ON MECHANICAL PROPERTIES OF SEVERAL OXIDE DISPERSION STRENGTHENED AND SUPERALLOY SHEET MATERIALS

J. Daniel Whittenberger Washington May 1977 67 p refs (NASA-TN-D-8493; E-9062) Avail: NTIS HC A04/MF A01 CSCL 11F

The effects of simulated multiple reentry into the earth's atmosphere on the mechanical properties of several high temperature metallic sheet materials were evaluated. The materials included five tin-gage (nominally 0.025- or 0.037-cm) oxide dispersion strengthened (ODS) alloys and two thin-gage (nominally 0.037-cm) superalloys. Multiple reentry conditions were simulated through cyclic Plasma Arc Tunnel (PAT) exposure. PAT exposure generally consisted of 100 cycles of 600 second duration at 1255, 1366, or 1477 K in a Mach 4.6 airstream with an impact pressure of nominally 800 N/m2. PAT exposure generally produced a uniform oxide scale, oxide pits or intergranular oxidation, Kirkendall porosity, and alloy depletion zones except for the aluminum-containing ODS alloys. Only a uniform oxide scale was formed on the aluminum-containing ODS alloys. PAT exposure did not significantly affect the mechanical properties of the thin-gage (nominally 0.025- or 0.037-cm) alloys evaluated. Thus it appears that the microstructural changes produced by Plasma Arc Tunnel exposure has little influence on mechanical properties. Author

N77-24254*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH TOUGHNESS-HIGH STRENGTH IRON ALLOY Patent Application

J. R. Stephens and W. R. Witzke, inventors (to NASA) Filed 6 Jun. 1977 12 p

(NASA-Case-Lew-12542-1; US-Patent-Appl-SN-803822) Avail: NTIS HC A02/MF A01 CSCL 11F

A steel alloy is provided which exhibits excellent strength and toughness characteristics at cryogenic temperatures. The alloy consists essentially of about 10 to 16 percent by weight nickel, about 0.1 to 1.0 percent by weight aluminum, and 0 to about 3 percent by weight of at least one of the following additional elements: copper, lanthanum, niobium, tantalum, titanium, vanadium, yttrium, zirconium and the rare earth metals, with the balance being essentially iron. The steel alloy is produced by a process which includes using cold rolling at room temperature and subsequent heat treatment at temperatures ranging from 500 to 650 C, and possesses a fracture toughness ranging from 200 to 230 ksi and yield strengths up to 230 ksi. NASA

N77-24255# Idaho National Engineering Lab., Idaho Falls.

CORROSION OF STAINLESS STEEL TYPE 304 ALLOYED WITH BORON OR GADOLINIUM BY PLANT PROCESS SOLUTIONS CONTAINING HNO3 AND HF

H. S. Cole Sep. 1976 28 p refs

(Contract E(10-1)-1375)

(ICP-1097) Avail: NTIS HC A03/MF A01

The coprocessing of aluminum and zirconium clad fuel elements, for the recovery of U235, utilizes highly corrosive solutions containing both nitrates and fluorides. These solutions may contact Type 304 stainless steel alloyed with boron or gadolinium for criticality safety. Corrosion tests, utilizing synthetic process solutions typical of plant operation, were conducted on four stainless steel alloys to determine any differences in corrosion due to the neutron absorbers alloyed 0.3 or 1.5 percent B, or 0.3 percent Gd into the steel. The use of zirconium as a chemically sacrificial metal and complexing with aluminum nitrate were also evaluated for corrosion mitigating ability. Corrosion rates were found to vary directly with the amount of neutron absorbing alloy present but could be reduced by utilizing B10 for alloying instead of natural boron. Zirconium metal or aluminum nitrate for complexing HF solutions were not as effective for corrosion control as reducing the neutral poison content in the alloy. Author (ERA)

N77-24256# Tel-Aviv Univ. (Israel).

ISOTOPE EFFECT IN THE SORPTION OF HYDROGEN ON TITANIUM

Paulina Millenbach Jun. 1976 50 p refs Transl. into ENGLISH of M.S. Thesis, Tel Aviv Univ., Sep. 1974, INIS-MF-1685

(UCRL-Trans-11111; LLL-02145) Avail: NTIS HC A03/MF A01

Protonic, covalent, and hydrogen anion models were used to investigate the chemical bonds in titanium hydrides. Thermodynamic quantities in the titanium hydrogen system were determined from dissociation pressures of the hydrides. There is some evidence that the dissociation pressures of the deuterides are higher than those of the corresponding hydrides. The absorption of mixtures and exchange of one isotope for the other were studied to determine the existence of a definite isotope effect. The exchange energy is 0.5 kcal/mole. ERA

N77-24257# Hanford Engineering Development Lab., Richland, Wash.

DEPENDENCE OF IRRADIATION CREEP ON TEMPERATURE AND ATOM DISPLACEMENTS IN 20% COLD WORKED TYPE 316 STAINLESS STEEL

E. R. Gilbert Apr. 1976 23 p refs Presented at Intern. Colloq. on Meas. of Irradiation Enhanced Creep in Nucl. Mater., Petten, Neth., 5 May 1976

(Contract E(45-1)-2170)

(HEDL-SA-824; Conf-760530-6) Avail: NTIS HC A02/MF A01

Irradiation creep studies with pressurized tubes of 20 percent cold worked Type 316 stainless steel conducted in EBR-2 show that as atom displacements are extended above 5 dpa and temperatures are increased above 375 C, the irradiation induced creep rate increases with both increasing atom displacements and increasing temperature. The stress exponent for irradiation induced creep remains near unity. Irradiation-induced effective creep strains up to 1.8 percent were observed without specimen failure. ERA

N77-24258# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.

POSITRON STUDIES OF FATIGUE, HYDROGEN EMBRIT-

TLEMENT AND RADIATION DAMAGE IN METALS
J. G. Byrne, P. Alexopoulos, F. Alex, T. D. Hadnagy, R. Waki, G. R. Miller, and R. W. Ure 1976 7 p refs Presented at 4th Intern. Conf. on Positron Annihilation, Helsingor, Den., 23 Aug. 1976
(Contract E(11-1)-2128)
(CONF-760848-1) Avail: NTIS HC A02/MF A01

Polycrystalline copper was followed in both cyclic softening and hardening with positron lifetime and x-ray particle size measurements. As initially hard copper is fatigue cycled, the mean positron lifetime decreases while the x-ray particle size increases. Similar correlation exists during fatigue hardening of initially soft copper. The trends indicate a positron response to decreasing dislocation density during fatigue softening and the converse during fatigue hardening. Hydrogen embrittlement effects in AISI 4340 steel and nickel were followed with mean positron lifetime. It appears that the effects are caused by mutual interaction of dislocations, protons, and positrons. In single crystal copper irradiated at 80 K and 4.5 MeV electrons, about 8 percent of the defects produced appear to be divacancies and the balance simple Frenkel defects. ERA

N77-24259# California Univ., Livermore. Lawrence Livermore Lab.
CRYOFORMING EVALUATION USING HIGH-PURITY NICKEL
D. E. Lord and L. F. Meisner 14 Sep. 1976 29 p refs
(Contract W-7405-eng-48)
(UCID-17265) Avail: NTIS HC A03/MF A01

Fast and slow strain rates were used in forming samples of 270 nickel at cryogenic and room temperatures. All samples were measured for failure strength at room temperature, and their strength preparation elongation curves compared at equal temperetures and strains. Cryoforming produced a 30 percent higher-strength nickel than that produced at room temperature at equal strains and strain rates. Forming rate effects disappeared as working temperature decreased. Rate-insensitive cryoforming produced a considerably stronger room-temperature material than room-temperature forming at high strain rates. Transmission electron microscopy indicates apparent structural differences between cryoformed and room-temperature-formed nickel. ERA

N77-24260# California Univ., Livermore. Lawrence Livermore Lab.
TENSILE PROPERTIES OF WELDED OR SENSITIZED 316 STAINLESS STEEL IN HIGH-PRESSURE HYDROGEN GAS
E. L. Raymond and R. R. Vandervoort 8 Sep. 1976 10 p refs
(Contract W-7405-eng-48)
(UCRL-52128) Avail: NTIS HC A02/MF A01

The effect of high-pressure hydrogen gas on the tensile properties of welded or sensitized 316 stainless steel was studied to find out if hydrogen embrittlement occurs. Tensile tests on unnotched and notched specimens in air, 70-MPa helium and 70-MPa hydrogen were conducted, using the air test results as baseline tensile properties. Results show that all specimens had good ductilities and were not notch-sensitive in high-pressure hydrogen. Fractographs reveal classic ductile-dimple failure in all specimens, but no evidence of hydrogen embrittlement. ERA

N77-24261# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
OPTIMIZATION OF STRENGTH AND DUCTILITY IN Fe-Mn TRIP STEELS
G. T. Haddick Jun. 1976 63 p refs
(Contract W-7405-eng-48)
(LBL-3986) Avail: NTIS HC A04/MF A01

The Fe-Mn alloys contained 16 to 20 percent Mn, 0 to 0.15 percent C, and 0 to 1.0 percent Mo. The mechanical properties of TRIP steels at room temperature depend on the M/sub s/ and M/sub d/ temperatures. In general, the strength and ductility of the 16 percent Mn steels improved with increasing alloy content while the 20 percent Mn alloys were less sensitive to increased alloy content. As the chemical composition was increased, the phase composition tended toward more epsilon martensite. This increase in the epsilon martensite content indicated that the M/sub d/ temperature was decreasing towards room temperature, and the effect of the decreasing M/sub d/ temperature showed itself in the variation of the mechanical properties. The 16 percent Mn alloy showed a 30 ksi yield strength and 30 percent elongation while the 16 percent Mn-0.08 percent C-1.0 percent Mo alloy had a 46 ksi yield strength and 46 percent elongation. ERA

N77-24262# Battelle Pacific Northwest Labs., Richland, Wash.
CRACK PROPAGATION SURVEILLANCE BY STRESS WAVE EMISSION USING A CONVERTED LEANORD LOCALIZER
E. G. Tomachevsky Feb. 1976 7 p Transl. into ENGLISH from Bull. Inf. Sci. Tech. (Paris), no. 211, Feb. 1976 7 p
(Contract E(45-1)-1830)
(BNWL-TR-192) Avail: NTIS HC A02/MF A01

Observation of the progress of a crack by detection of stress wave emission (SWE) is perturbed by mechanical parasites from the trail equipment and also by electrical parasites. Since these parasites are perfectly localized they can be eliminated by means of a localizer, if special adjustments are made and the apparatus is slightly modified. ERA

N77-24263# Oak Ridge Gaseous Diffusion Plant, Tenn. Dept. of Chemical Analysis.
FORMATION OF CORROSION-RESISTANT OXIDE FILM ON URANIUM
G. S. Petit 15 Oct. 1976 21 p refs Presented at the Integrated Contractors Meeting on Coatings and the Joint Working Group 12A Coating Meeting, Livermore, Calif., 25-28 Oct. 1976
(Contract W-7405-eng-26)
(K/TL-613; Conf-761048-1) Avail: NTIS HC A02/MF A01

A vacuum heat treatment method was developed for coating metallic uranium with an adherent protective film of uranium oxide. The film is prepared by vacuum heat treating the metallic uranium at 625 C for 1 h while controlling the amount of oxygen being metered into the furnace. Uranium coupons with the protective film were exposed for several hundred hours in a corrosion test bath at 95 C and 100 percent RH without corroding. Film thicknesses ranging from 5 to 25 micrometers (0.0002 to 0.001 in.) were prepared and corrosion tested; the film thickness is controlled to less than + or - 2.5 micrometers (+ or - 0.0001 in.). The oxide film is hard, nonwetting, and very adherent. The resulting surface finish of the metal is equivalent to that of the original finish. The advantages of the oxide films over other protective coatings are given. ERA

N77-24264# Oak Ridge National Lab., Tenn.
TEMPERATURE GRADIENT COMPATIBILITY TESTS OF SOME REFRACTORY METALS AND ALLOYS IN BISMUTH AND BISMUTH-LITHIUM SOLUTIONS
J. R. DiStefano and O. B. Cavin Nov. 1976 38 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5503) Avail: NTIS HC A03/MF A01

Quartz, T-111, and Mo thermal-convection loop tests were conducted at temperatures up to 700 C to determine the compatibility of several refractory metals/alloys with bismuth and bismuth-lithium solutions for molten salt breeder reactor applications. Methods of evaluation included weight change measurements, metallographic examination, chemical and electron microprobe analysis, and mechanical properties tests. Molybdenum, T-111, and TA-10 percent W were the most promising containment materials, while niobium and iron-based alloys are unacceptable. ERA

N77-24265# Oak Ridge National Lab., Tenn. Chemistry Div.
CORROSIVITY OF GEOTHERMAL BRINES Progress Report
F. A. Posey and A. A. Packo Dec. 1976 35 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5688) Avail: NTIS HC A03/MF A01

The corrosivity of ferrous materials in synthetic geothermal brines was studied. Electrochemical measurements on the spontaneous corrosion potentials and corrosion rates, and on the kinetics of the anodic and cathodic corrosion reactions of iron and carbon steel were made in 4 M NaCl solution over the pH range from 1 to 11 at temperatures up to 100 C in a conventional Pyrex electrochemical cell. A refreshed, stirred titanium autoclave system was designed, constructed, and tested, and will be used for making electrochemical measurements in synthetic brines up to at least 200 C. The effect of pH on

10.0022, THEORETICAL PLANETARY PHYSICS
J.J. CALDWELL, State University of New York, Graduate School, *Stony Brook, New York* 11790 (NSG 7320)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0023, INVESTIGATION OF FLARE STARS
D.S. EVANS, Univ. of Texas, School of Arts & Sciences, *Austin, Texas* 78712 (AST75-03977 A01)

An extensive program of monitoring flare stars will be carried out. Photoelectric measurements of certain selected stars, such as UV Ceti and CM Draconis, will be made in order to test the extent to which membership in a binary system affects the flare phenomenon. A selection of early-type stars will also be monitored in order to extend the statistics of the flare phenomenon. Simultaneous photometric and spectroscopic studies with a time resolution of 5 to 10 seconds will be made of particular flares. Conventional photometry of certain known flare stars will be made in order to see if there are small periodic variations in luminosity. Multiple stellar systems which contain flare stars will be investigated in order to devise programs which may shed light on the origin and evolution of flare stars.

SUPPORTED BY U.S. Natl. Science Foundation

10.0024, COPERNICUS OBSERVATIONS OF STELLAR WINDS IN EARLY B-TYPE STARS
M.A. SMITH, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (NSG 5167)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0025, ANALYSIS OF DATA ON VERY HIGH ENERGY GALACTIC ELECTRONS
J.J. LORD, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (NSG 7318)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

GENERAL

11.0001, DEVELOPMENT AND IMPLEMENTATION OF A MINORITY INDUSTRIAL ASSISTANCE PROGRAM
UNKNOWN, Univ. of Southern California, Graduate School, *Los Angeles, California* 90007 (NASW 3009)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0002, ELEMENTS OF SEARCH STRATEGY FOR SETI
C.L. SEEGER, Calif. State Univ. & Colleges, Graduate School, *San Francisco, California* 94132 (NSG 2210)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0003, COLLECTION AND ANALYSIS OF INFORMATION RELATING TO TECHNOLOGY TRANSFER AND APPLICATION
UNKNOWN, Univ. of Denver, Graduate School, *Denver, Colorado* 80210 (NASW 3021)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0004, DEVELOP PLAN TO ASSEMBLE SAR/LANDSAT DATA SETS
P.E. ANUTA, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (NAS 6-2816)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0005, OPERATION OF A STATE TECHNICAL APPLICATION PROGRAM
UNKNOWN, Univ. of Kentucky, Graduate School, *Lexington, Kentucky* 40506 (NASW 3039)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0006, TECHNICAL SERVICE OPERATIONS AND MATERIALS FOR CATALOGUING BOOKS AND OTHER MATERIAL
J.P. LEWIS, Columbia University, Graduate School, *New York, New York* 10027 (NAS 5-24080)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11.0007, SYMPOSIUM ON AERONAUTICS AND SPACE AIMED AT MOTIVATING MINORITIES AND WOMEN TOWARD SCIENCE
G. THOMAS, Univ. of Oklahoma, Graduate School, *Norman, Oklahoma* 73069 (NASW 3020)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N77-24052*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DYNAMICS OF ULTRALIGHT AIRCRAFT: MOTION IN VERTICAL GUSTS
Robert T. Jones Apr. 1977 12 p refs
(NASA-TM-X-73228; A-6947) Avail: NTIS HC A02/MF A01 CSCL 01A

Gust load calculations are extended to the range of conditions encountered by ultralight aircraft such as hang gliders. Having wing loadings of the order of 5 kg/sq m, these gliders acquire a substantial fraction of the motion of a gust within a distance of 1 or 2 m. Comparative loads and displacements for a small powered airplane having a wing loading of 50 kg sq m and for a commercial jet with 500 kg sq m are shown. Author

N77-24053*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DYNAMICS OF ULTRALIGHT AIRCRAFT: DIVE RECOVERY OF HANG GLIDERS
Robert T. Jones May 1977 15 p refs
(NASA-TM-X-73229; A-6989) Avail: NTIS HC A02/MF A01 CSCL 01A

Longitudinal control of a hang glider by weight shift is not always adequate for recovery from a vertical dive. According to Lanchester's phugoid theory, recovery from rest to horizontal flight ought to be possible within a distance equal to three times the height of fall needed to acquire level flight velocity. A hang glider, having a wing loading of 5 kg sq m and capable of developing a lift coefficient of 1.0, should recover to horizontal flight within a vertical distance of about 12 m. The minimum recovery distance can be closely approached if the glider is equipped with a small all-moveable tail surface having sufficient upward deflection. Author

N77-24054# RCA Government and Commercial Systems, Burlington, Mass. Automated Systems Div.
FIELD EVALUATION OF UH-1 HELICOPTER INSPECTION SYSTEMS. PROJECT INSPECT, PHASE 2 Final Report, 1 May 1974 - 31 May 1976
Fred W. Hohn, Bruce B. Wierenga et al Nov. 1976 248 p refs
(Contract DAAJ02-74-C-0044)
(AD-A033721; USAAMRDL-TR-76-27) Avail: NTIS HC A11/MF A01 CSCL 15/5

Project Inspect was established to analyze aircraft maintenance scheduled inspections and to design an improved schedule inspection scheme that will function effectively in the era of the volunteer Army. Various priorities associated with preventive maintenance scheduled inspection systems of Army aircraft were studied, and the resulting restructuring of these systems is based on the analysis of historical data and the modeling results of a developed computer program, MAVIS (Model for Analysis of Vehicle Inspection Systems). The output of this effort indicated that proper scheduling of individual component inspections based on failure and failure detection historical data permits an increase in inspection intervals, resulting in increased efficiency and maintenance cost savings. Project Inspect then developed a phased checklist for the UH-1H Helicopter. The implementation of a scientifically derived phased inspection schedule with opened intervals should result in greater inspection efficiency, reduced maintenance costs, and increased operational readiness. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N77-24055*# Kaman Aerospace Corp., Bloomfield, Conn.
DESIGN STUDY OF A FEEDBACK CONTROL SYSTEM FOR THE MULTICYCLIC FLAP SYSTEM ROTOR (MFS) Final Report
R. Weisbrich, R. Perley, and H. Howes 21 Jan. 1977 90 p refs
(Contract NAS2-8726)
(NASA-CR-151960; R-1494) Avail: NTIS HC A05/MF A01 CSCL 01A

The feasibility of automatically providing higher harmonic control to a deflectable control flap at the tip of a helicopter rotor blade through feedback of selected independent parameter was investigated. Control parameters were selected for input to the feedback system. A preliminary circuit was designed to condition the selected parameters, weigh limiting factors, and provide a proper output signal to the multi-cyclic control actuators. Results indicate that feedback control for the higher harmonic is feasible; however, design for a flight system requires an extension of the present analysis which was done for one flight condition - 120 kts, 11,500 lbs gross weight and level flight. Author

N77-24056*# Kanner (Leo) Associates, Redwood City, Calif.
QUANTITATIVE STUDY OF THREE-DIMENSIONAL FLOW FIELDS AROUND FLIGHT VEHICLES IN THE CASE OF SUPERSONIC FLOW BY MEANS OF OPTICAL METHODS
G. Schwarz Washington NASA May 1977 24 p refs Transl. into ENGLISH of paper 76-172, presented at the 9th Ann. Congr. of the Ger. Soc. for Aeron. and Astronautics, Munich, 14-16 Sep. 1976 16 p
(Contract NASw-2790)
(NASA-TT-F-17428) Avail: NTIS HC A02/MF A01 CSCL 01A

Asymmetrical, three dimensional density fields around bodies in a supersonic flow are evaluated using interferograms, schlieren photography and tinged photographs. Author

N77-24057*# McDonnell-Douglas Corp., Long Beach, Calif.
A COMPUTER PROGRAM FOR CALCULATING THREE-

DIMENSIONAL COMPRESSIBLE LAMINAR AND TURBULENT BOUNDARY LAYERS ON ARBITRARY WINGS
Tuncer Cebeci, Kalle Kaups, and Judy A. Ramsey May 1977 64 p refs Sponsored by NASA
(NASA-CR-145194) Avail: NTIS HC A04/MF A01 CSCL 01A

A computer program for calculating three dimensional compressible laminar and turbulent boundary layers on arbitrary wings is described and presented. The computer program consists of three separate programs, namely, a geometry program to represent the wing analytically, a velocity program to compute the external velocity components from a given experimental pressure distribution and a finite difference boundary layer method to solve the governing equations for compressible flows. To illustrate the usage of the computer program, three different test cases are presented and the preparation of the input data as well as the computed output data is discussed in some detail. Author

N77-24058*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSITION AND LAMINAR INSTABILITY
Leslie M. Mack 15 May 1977 84 p refs
(Contract NAS7-100)
(NASA-CR-153203; JPL-Publ-77-15) Avail: NTIS HC A05/MF A01 CSCL 01A

The linear stability theory was applied to the problem of boundary layer transition in incompressible flow. The theory was put into a form suitable for three-dimensional boundary layers; both the temporal and spatial theories were examined; and a generalized Gaster relation for three-dimensional boundary layers was derived. Numerical examples include the stability characteristics of Falkner-Skan boundary layers, the accuracy of the two-dimensional Gaster relation for these boundary layers, and the magnitude and direction of the group velocity for oblique waves in the Blasius boundary layer. Available experiments which bear on the validity of stability theory and its relation to transition are reviewed and the stability theory is applied to transition prediction. The amplitude method is described in which the wide band disturbance amplitude in the boundary layer is estimated from stability theory and an interaction relation for the initial amplitude density of the most unstable frequency.

N77-24059*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL STUDY OF THE EFFECT OF GROUND PROXIMITY ON THE INDUCED EFFICIENCY OF HELICOPTER ROTORS
Harry H. Heyson 3 May 1977 90 p refs
(NASA-TM-X-71951) Avail: NTIS HC A05/MF A01 CSCL 01A

A study of rotors in forward flight within ground effect showed that the ground-induced interference is an upwash and a decrease in forward velocity. The interference velocities are large, oppose the normal flow through the rotor, and have large effects on the induced efficiency. Hovering with small ground clearances may result in significant blade stall. As speed is increased from hover in ground effect, power initially increases rather than decreases. At very low heights above the ground, the power requirements become nonlinear with speed as a result of the streamwise interference. The streamwise interference becomes greater as the wake approaches the ground and eventually distorts the wake to form the ground vortex which contributes to certain observed directional stability problems. Author

N77-24060*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INVESTIGATION OF INLET CONCEPTS FOR MANEUVER IMPROVEMENT AT TRANSONIC SPEEDS
Eldon Latham, John Gawienowski, and Frank Meriwether Apr. 1977 61 p ref
(NASA-TM-X-73215; A-6952) Avail: NTIS HC A04/MF A01 CSCL 01A

A 15 percent scale lightweight fighter type inlet forebody was tested in the Ames 14 foot transonic wind tunnel at Mach numbers of 0.7, 0.9, and 1.04. The inlet was a two dimensional horizontal ramp system designed for a Mach number of 2.2. Four inlet devices designed to prevent or delay cowl-lip boundary layer separation or to improve the inlet internal flow characteristics at high angles of attack were investigated. The devices used to control cowl-lip separation consisted of cowl leading edge flaps, slotted flaps, and tangential blowing. To improve the internal flow characteristics, discrete jet nozzle flows were directed downstream and parallel to the duct surface in the subsonic diffuser to energize the wall boundary layer. The discrete jets used in the subsonic diffuser were also tested in combination with each of the cowl leading edge devices. Test measurements included engine-face total pressure recovery, steady state distortion, dynamic distortion, duct boundary layer profiles, and duct-surface static pressures. Author

N77-24061*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS AT MACH 6 OF A HYPERSONIC RESEARCH AIRPLANE CONCEPT HAVING A 70 DEG SWEPT DELTA WING
Louis E. Clark and Christine B. Richie Washington May 1977 60 p refs
(NASA-TM-X-3475; L-10712) Avail: NTIS HC A04/MF A01 CSCL 01A

The hypersonic aerodynamic characteristics of an air-launched, delta-wing research aircraft concept were investigated at Mach 6. The effect of various components such as nose shape, wing camber, wing location, center vertical tail, wing tip fins, forward delta wing, engine nacelle, and speed brakes was also studied. Tests were conducted with a 0.021 scale model at a Reynolds number, based on model length, of 10.5 million and over an angel of attack range from -4 deg to 20 deg. Results show that most configurations with a center vertical tail have static longitudinal stability at trim, static directional stability at angles of attack up to 12 deg, and static lateral stability throughout the angle of attack range. Configurations with wing tip fins generally have static longitudinal stability at trim, have lateral stability at angles of attack above 8 deg, and are directionally unstable over the angle of attack range. Author

N77-24062*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATIONS, AND COMPARISON WITH AN IDEAL MINIMUM, OF TRIMMED DRAG FOR CONVENTIONAL AND CANARD CONFIGURATIONS HAVING VARIOUS LEVELS OF STATIC STABILITY
Milton D. McLaughlin Washington May 1977 24 p refs
(NASA-TN-D-8391; L-11016) Avail: NTIS HC A02/MF A01 CSCL 01A

Classical drag equations were used to calculate total and induced drag and ratios of stabilizer lift to wing lift for a variety of conventional and canard configurations. The Flight efficiencies of such configurations that are trimmed in pitch and have various values of static margin are evaluated. Classical calculation methods are compared with more modern lifting surface theory. Author

N77-24063# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
WIND TUNNEL MEASUREMENTS IN THE BOUNDARY LAYER ON A 3-D SWEPT WING Final Report
A. Bertelrud 1976 112 p refs
(Contracts F-INK-82223-74-001-07-001; F-INK-82223-75-007-07-001; F-INK-82223-76-001-21-001)
(FFA-TN-AU-1191) Avail: NTIS HC A06/MF A01

Measurements in a low speed wind tunnel are reported. The tests are part of a project concerning extrapolation from wind tunnel to flight, and comparative flight tests are planned. The wing was the outer part of the actual wing of a SAAB 32 Lansen attack aircraft and had natural service roughness. The wing was tested at angles of attack from zero to 12 deg (geometrical), and in a unit Reynolds number range of 0.7 to 3.4x10 to the 6th power. Some wake profile measurements are also included. Flow visualizations showed that the surface streamlines were approximately straight and parallel, and from other smoke and tuft tests (at various surface distances) the velocity profiles appear to have only moderate crossflow components. The profiles were measured by means of total head rakes and the local skin friction was measured with Preston tubes and surface total head/static probes. The results indicated that these two methods differ from the Clauser chart generally by less than 5%, despite relatively strong pressure gradients.

The wing had leading edge separation type, and tests with tape as transition trip near the leading edge explained some phenomena observed in earlier flight tests with aircraft of the same type.
Author (ESA)

N77-24064# European Space Agency, Paris (France).
SHOCK RECOMPRESSION OF A SUPERSONIC INTERNAL FLOW IN THE PRESENCE OF A BOUNDARY LAYER BLEED
Georges Meauze Mar. 1977 78 p refs Transl. into ENGLISH of 'Recompression par Choc d'un Ecoulement Interne Supersonique en Presence d'un Piege a Couche Limite', ONERA, Paris Report ONERA-NT-1976-8, 1976 Original report in FRENCH previously announced as N77-20388
(ESA-TT-369; ONERA-NT-1976-8) Avail: NTIS HC A05/MF A01

To improve the understanding of the functioning of a boundary layer bleed in a supersonic, internal compression, air intake, with particular regard to the influence of various design parameters on recompression efficiency and stability, an experimental facility was made which incorporates a high degree of flexibility. In the experimental model the particular problem of the boundary layer bleed was separated from the general study of the supersonic air intake by creating, in a nozzle, a flow at the Mach number reached at the end of the internal recompression in a supersonic intake thus eliminating all phenomena occurring before the bleed. Various shapes of bleed were tested at Mach number 1.12, 1.42, and 1.72. The experiments made it possible to propose a simple theoretical model from which a calculation method was developed. The theoretical method is shown to predict the experimental results and allow optimization, for a given entry upstream flow, of the bleed geometry. Author (ESA)

N77-24065# European Space Agency, Paris (France).
UNSTEADY PRESSURE MEASUREMENTS IN ROTOR BLADE TIPS WITH INCIDENCE IN INCOMPRESSIBLE FLOW
Hermann Triebstein Apr. 1977 58 p refs Transl. into ENGLISH of 'Instationaere Druckverteilungsmessungen an angestellten Rotorblattspitzen in inkompressibler Stroemung', DFVLR, Goettingen, West Ger. Report DLR-FB-76-42, 11 Aug. 1976 Original report in GERMAN previously announced as N77-20038 Original German report available from DFVLR, Cologne DM 28.70
(ESA-TT-374; DLR-FB-76-42) Avail: NTIS HC A04/MF A01

The measurement of unsteady pressure on harmonically oscillating rotor blade tips, in incompressible subsonic flow is dealt with. The measurements were made in a subsonic wind tunnel. The pressure was measured in five sections, allowing the three-dimensionality of the pressure distributions to be well observed. The flow speed was V = 45 m/s and the oscillation frequencies were f = 2, 4, and 6 Hz. The oscillation amplitudes ran from B = 1 to 3 deg and the angles of attack were 0, 3, 6, 9, and 12 deg. Test facilities are described. Author (ESA)

N77-24066# European Space Agency, Paris (France).
INFLUENCE OF THE BOUNDARY LAYER THICKNESS ON THE BASE PRESSURE IN TWO-DIMENSIONAL AND AXISYMMETRIC SUPERSONIC FLOWS
Mauri Tanner Apr. 1977 32 p refs Transl. into ENGLISH of 'Einfluss der Grenzschichtdicke auf den Basisdruck bei zweidimensionaler u. rotationssymmetrischer Ueberschallstroemung', DFVLR, Goettingen, West Ger. Report DLR-FB-76-43, 12 Aug. 1976 Original report in GERMAN previously announced as N77-20039 Original German report available from DFVLR, Cologne DM 18.60
(ESA-TT-375; DLR-FB-76-43) Avail: NTIS HC A03/MF A01

Equations were developed for the prediction of the influence of the boundary layer thickness on the base pressure in two-dimensional and axisymmetric supersonic flow. Results show that, for an equal increment of the boundary layer thickness, the increase of the base pressure is smaller when the Mach number becomes greater. Author (ESA)

N77-24067# European Space Agency, Paris (France).
CALCULATION OF THE PRESSURE DISTRIBUTION ON HARMONICALLY OSCILLATING BODIES IN INCOMPRESSIBLE FLOW
Wolfgang Geissler Apr. 1977 37 p refs Transl. into ENGLISH of 'Berechnung der Druckverteilung an harmonisch oszillierenden dicken Ruempfen in inkompressibler Stroemung', DFVLR, Goettingen, West Ger. Report DLR-FB-76-48, 3 Oct. 1976 Original report in GERMAN previously announced as N77-20040 Original German report available from DFVLR, Cologne DM 17.90
(ESA-TT-376; DLR-FB-76-48) Avail: NTIS HC A03/MF A01

A numerical method to calculate pressure distributions on thick axisymmetric bodies oscillating in pitching and plunging modes in a parallel flow is presented. A static angle of attack is taken into account for the unsteady calculations. It is not assumed that the amplitudes of oscillation are small compared to a characteristic body length. The method uses arbitrary source-sink distributions on the real body surface. The geometrical boundary condition and the Bernoulli equation for the calculation of pressures are nonlinearized. Besides determination of steady pressures and unsteady pressures of the first harmonic it is shown that the method can be used to calculate the second and higher harmonics of the unsteady motion. Author (ESA)

N77-24068# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
STABILITY AND CONTROL CHARACTERISTICS OF THE WINGLET CONFIGURED KC-135A M.S. Thesis
Kent R. Crenshaw Dec. 1976 193 p refs
(AD-A034940; GAE/MC/76D-5) Avail: NTIS HC A09/MF A01 CSCL 01/3

Using the Boeing FLEXSTAB digital computer system, rigid and elastic models of the winglet configured KC-135A are made. With a rigid analysis, the winglets reduce total drag from 2 to almost 8% with improvements both laterally and longitudinally in static stability. Dynamically, the rigid winglet model is more stable laterally but slightly more oscillatory longitudinally. The lateral dutch roll mode damping ratio increased with winglets from 3 to 12% with only a 3% increase in frequency. Elastic static stability is still improved both laterally and longitudinally with winglets; and dynamically, the winglets improve lateral stability with very little effect longitudinally. With aeroelastic effects, the overall benefit derived from winglet application to the model is less. However, no significant detrimental effects due to winglets are found. GRA

N77-24069# TRW Defense and Space Systems Group, Redondo Beach, Calif.
AN INVESTIGATION OF NOSE BLUNTNESS EFFECTS ON TRANSITION ASYMMETRY AND TRANSITION AERODYNAMICS Final Report, May - Sep. 1976
Gerald Gustafson 30 Sep. 1976 42 p refs
(Contract F04701-75-C-0163)
(AD-A033886; TRW-28513-6014-RU-00; SAMSO-TR-76-102)
Avail: NTIS HC A03/MF A01 CSCL 01/1

The effects of wind fixed boundary layer transition on reentry vehicle aerodynamics plays an important role in determining high altitude trajectory dispersions. An investigation was undertaken to determine the effects of nose bluntness on boundary layer transition asymmetry and transitional aerodynamic perturbations at angle of attack. The results of previous experimental investigations of asymmetric transition are reviewed. An experimental program using the Calspan 96-inch shock tunnel to investigate bluntness effects on transition asymmetry and related aerodynamic perturbations is discussed. Data from the test program will be published in a future report. Author (GRA)

N77-24070# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
AN EXPERIMENTAL INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF NOSE MOUNTED CANARD CONFIGURATIONS AT SUPERSONIC MACH NUMBERS (1.5 THROUGH 4.5)
James R. Burt, Jr. 10 Oct. 1976 352 p
(DA Proj. 1M3-62303-A214)
(AD-A033783; RD-77-5) Avail: NTIS HC A16/MF A01 CSCL 20/4

Experimental aerodynamic investigations were conducted in a supersonic wind tunnel to determine the aerodynamic characteristics of several nose mounted canard wing configurations. Canard position, geometry, angular orientation, and model nose shape were varied systematically to determine their effects

on model aerodynamics. The model was tested at angles of attack of -5 to 13 degrees and Mach numbers of 1.5 to 4.5. Aerodynamic loads were measured separately on four canards and tail panels, and the total model. The vapor screen method was used to trace the paths of the vortices shed from the canards. Roll control effectiveness of canards, both with a planar tail and a ring tail was investigated. GRA

N77-24071# Mississippi State Univ., Mississippi State. Dept. of Aerophysics and Aerospace Engineering.
AN IMPROVED ALGEBRAIC RELATION FOR THE CALCULATION OF REYNOLDS STRESSES Interim Report
Z. U. Warsi and B. B. Amlicke Nov. 1976 10 p refs
(Grant AF-AFOSR-2922-76)
(AD-A033655; AASE-76-156; AFOSR-76-1240TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

In this paper an algebraic relation for the Reynolds Stresses has been obtained through a consideration of the transport equations of the Reynolds Stresses. This analysis provides a second-order approximation to the Boussinesq eddy viscosity hypothesis. The basic assumption of the analysis is that the derivatives of the ratio of the Reynolds Stresses and energy is small in comparison with the other terms. Author (GRA)

N77-24072# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
SUDDEN DECELERATION OF A FREE JET AT THE ENTRANCE OF A CHANNEL Interim Report
Roger W. Gallington Jan. 1976 16 p refs
(AD-A033659; DTNSRDC/ASED-350) Avail: NTIS HC A02/MF A01 CSCL 20/4

A family of two-dimensional potential flows is derived which may describe the interaction of a propulsion jet with the leading edge of a thin wing-in-ground effect at zero angle of attack with a deflected trailing edge flap. Assuming that such flows occur at the leading edge, the static performances of this arrangement-called the power augmented ram wing-are derived as functions of geometry. A minimum power point is found for given thrust and lift. At this minimum power point, the wing can be held about one-tenth of its chord above the surface while providing a lift force of about six times the installed thrust and recovering about four-fifths of the installed thrust.
Author (GRA)

N77-24073# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
THEORY OF POWER AUGMENTED RAM LIFT AT ZERO FORWARD SPEED Interim Report
Harvey R. Chaplin and Harvey R. Chaplin Feb. 1976 14 p refs
(AD-A033673; DTNSRDC/ASED-365) Avail: NTIS HC A02/MF A01 CSCL 20/4

Recent experiments by Huffman and Jackson demonstrated the possibility of an air cushion operating mode for an aircraft with low aspect ratio endplated wings wherein the propulsion system is mounted forward of the wing and exhausted into the space between the wing and the ground to generate high pressures for wing lift at zero forward speed. Gallington has derived two-dimensional potential flows relevant to this phenomenon, but applying to larger ratios of propulsive jet area to leading edge air gap area (height of wing above ground times wing span) than were employed in the experiments. In this report, simple momentum theory is applied to obtain performance estimates for a range of jet area ratios from zero to the limiting cases of the potential flow solutions. Reasonable agreement with experiment is found, suggesting that two-dimensional flow models may give useful estimates of the performance potential of such systems. It is found that, under conditions such that a large fraction of the propulsion system thrust is recovered as useful propulsive thrust, the ratio of lift to thrust is very sensitive to the jet area ratio and optimum performance is obtained for jet area ratios approaching unity. Additional experiments are needed, covering the full range of jet area ratios, to evaluate the practical potential of power augmented ram lift systems.
Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N77-24074*# Lockheed-California Co., Burbank.
STUDY OF THE IMPACT OF CRUISE SPEED ON SCHEDULING AND PRODUCTIVITY OF COMMERCIAL TRANSPORT AIRCRAFT Final Report, Jun. 1976 - Mar. 1977
E. Q. Bond, E. A. Carroll, and R. A. Flume Apr. 1977 108 p Prepared in cooperation with Trans World Airlines, Inc., Kansas City, Mo. and Braniff International
(Contract NAS1-14435)
(NASA-CR-145189; LR-28114) Avail: NTIS HC A06/MF A01 CSCL 01C

A comparison is made between airplane productivity and utilization levels derived from commercial airline type schedules which were developed for two subsonic and four supersonic cruise speed aircraft. The cruise speed component is the only difference between the schedules which are based on 1995 passenger demand forecasts. Productivity-to-speed relationships were determined for the three discrete route systems: North Atlantic, Trans-Pacific, and North-South America. Selected combinations of these route systems were also studied. Other areas affecting the productivity-to-speed relationship such as aircraft design range and scheduled turn time were examined.
Author

N77-24075# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT. CIVIL AVIATION, ISSUE NUMBER 2, 1976 ACCIDENTS
15 Dec. 1976 519 p
(NTSB-BA-76-7) Avail: NTIS HC A22/MF A01

The facts, conditions, circumstances, and probable causes of 899 randomly selected general aviation accidents occurring in U.S. civil aviation operations during calendar year 1976 are described in brief format. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N77-24076*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 15 Oct. 1976 - 14 Jan. 1977
Washington May 1977 74 p refs Prepared in cooperation with Battelle Columbus Labs., Mountain View, Calif.
(NASA-TM-X-3546; A-7001) Avail: NTIS HC A04/MF A01 CSCL 01C

During the third quarter of operation of the Aviation Safety Reporting System (ASRS), 1429 reports concerning aviation safety were received from pilots, air traffic controllers, and others in the national aviation system. Details of the administration and results of the program are discussed. The design and construction of the ASRS data base are briefly presented. Altitude deviations and potential aircraft conflicts associated with misunderstood clearances were studied and the results are discussed. Summary data regarding alert bulletins, examples of alert bulletins and responses to them, and a sample of deidentified ASRS reports are provided. Author

N77-24077# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
DEVELOPMENT OF A HYDROFLUIDIC VERNIER ROCKET CONTROL SYSTEM FOR EJECTION SEAT STABILIZATION Final Report, 1 Mar. - 1 Nov. 1976
R. V. Burton and R. B. Beale Dec. 1976 63 p refs
(Contract N00019-76-C-0374; WF53532403)
(AD-A034543; F0440-FR; Honeywell-77-SRC/1) Avail: NTIS HC A04/MF A01 CSCL 01/3

A feasibility demonstration model of a fluidic thrust vector control (FTVC) system was designed, fabricated, and tested for pitch stabilization of ejection seats using the STAPAC vernier

rocket. The control system includes a rate sensor, amplifier, attitude memory, and a position-controlled hydrofluidic servoactuator. The measured dynamic response of the control system closely matched the theoretical specifications for stable attitude control of the seat. The hardware was tested on a hydraulic rate table without rocket firing. Author (GRA)

N77-24078# Air Force Armament Lab., Eglin AFB, Fla.
INVESTIGATION OF POSSIBLE FIN FAILURES OF GBU-10 AND GBU-12 BOMBS CARRIED ON THE INBOARD WING STATION OF AN F-4 AIRCRAFT
Alfred V. Marrin Aug. 1976 303 p refs
(AD-A033340; AFATL-TR-76-85) Avail: NTIS HC A14/MF A01 CSCL 19/4

This report documents a study performed to isolate the cause of a collision between an F-4 aircraft and a GBU-12 bomb. The study was generalized to predict the resulting GBU-10 bomb trajectory conditions. Author (GRA)

N77-24079# Simat, Helliesen and Eichner, Inc., Washington, D. C.
AN ANALYSIS OF THE EFFECTS OF ROUTE RESTRICTION REMOVAL AND DISCRETIONARY AUTHORITY: THE TRANSITION TO A LESS-REGULATED ENVIRONMENT, VOLUME 1
Jan. 1977 147 p refs 3 Vol.
(Contract DOT-OS-60155)
(PB-263685/0; DOT/RAD-12-Vol-1) Avail: NTIS HC A07/MF A01; also available in set of 3 reports, PB-263684-SET, HC E21 CSCL 01B

The consequences to be expected during a transition to greater competition in scheduled interstate air transportation are considered. The conditions studied included the removal of all the certificate restrictions the CAB has placed on existing carriers and, simultaneously, a limited discretionary expansion of carriers' existing route structures. A profile of each trunk line and local service carrier was developed. The consequences of probably entry and exit scenarios were projected for each carrier, for each of the markets it serves, in terms of load factors, ASM', PRM's, and flight frequencies. GRA

N77-24080# Simat, Helliesen and Eichner, Inc., Washington, D. C.
AN ANALYSIS OF THE EFFECTS OF ROUTE RESTRICTION REMOVAL AND DISCRETIONARY AUTHORITY: THE TRANSITION TO A LESS-REGULATED ENVIRONMENT. VOLUME 2: TRUCK AIRLINE Final Report
Jan. 1977 508 p refs 2 Vol.
(Contract DOT-OS-60155)
(PB-263686/8; DOT/RAD-12-Vol-2) Avail: NTIS HC A22/MF A01; also available in set of 3 reports, PB-263684-SET, HC C21 CSCL 01B

The consequences to be expected during a transition to greater competition in scheduled interstate air transportation is discussed. Profiles identify, by market, each carrier's vulnerability to entry on its routes by other carriers, and the corresponding opportunities it in turn has to enter new markets. Profiles of trunk line carriers are reported. GRA

N77-24081# Simat, Helliesen and Eichner, Inc., Washington, D. C.
AN ANALYSIS OF THE EFFECTS OF ROUTE RESTRICTION REMOVAL AND DISCRETIONARY AUTHORITY: THE TRANSITION TO A LESS-REGULATED ENVIRONMENT. VOLUME 3: LOCAL SERVICE CARRIER PROFILES Final Report
Jan. 1977 327 p refs 3 Vol.
(Contract DOT-OS-60155)
(PB-263687/6; DOT/RAD-12-Vol-3) Avail: NTIS HC A15/MF A01; also available in set of 3 reports, PB-263684-SET, HC E21 CSCL 01B

Competition, traffic profiles, productivity, and market relations of local service air carriers are studied. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N77-24082*# Champlain Technology, Inc., West Palm Beach, Fla.
AN AVIONICS SENSITIVITY STUDY. VOLUME 1: OPERATIONAL CONSIDERATIONS Final Report, Aug. 1975 - Sep. 1976
Ronald W. Scott and Edwin D. McConkey Sep. 1976 230 p refs Prepared for Systems Control, Inc., Palo Alto, Calif.
(Contract NAS1-14144)
(NASA-CR-145107) Avail: NTIS HC A11/MF A01 CSCL 17G

Equipment and operational concepts affecting aircraft in the terminal area are reported. Curved approach applications and modified climb and descent procedures for minimum fuel consumption are considered. The curved approach study involves the application of MLS guidance to enable execution of the current visual approach to Washington National Airport under instrument flight conditions. The operational significance and the flight path control requirements involved in the application of curved approach paths to this situation are considered. Alternative flight path control regimes are considered to achieve minimum fuel consumption subject to constraints related to air traffic control requirements, flight crew and passenger reactions, and airframe and powerplant limitations. Author

N77-24083*# Systems Control, Inc., Palo Alto, Calif.
AN AVIONICS SENSITIVITY STUDY. VOLUME 2: EVALUATION OF AIRBORNE NAVIGATION SYSTEM PERFORMANCE DURING RNAV/MLS TRANSITION Final Report, Aug. 1975 - Sep. 1976
Walter Heine Sep. 1976 115 p refs
(Contract NAS1-14144)
(NASA-CR-145108) Avail: NTIS HC A06/MF A01 CSCL 17G

A computer simulation was modified to generate a suitable data base for performance of an avionics sensitivity study during RNAV/MLS transition. The avionics sensitivity data provides information necessary to establish requirements for additional guidance law design during transition and to establish airspace requirements for maneuvering to null out any residual RNAV errors upon MLS transition. The data base is also beneficial as planning information for subsequent flight testing. Author

N77-24084*# Systems Control, Inc., Palo Alto, Calif.
AN AVIONICS SENSITIVITY STUDY. VOLUME 3: AUTOMATED RNAV/MLS TRANSITION
Jaxant S. Karmarkar Mar. 1977 36 p refs
(Contract NAS1-14144)
(NASA-CR-145109) Avail: NTIS HC A03/MF A01 CSCL 17G

An automated algorithm for transitioning from RNAV to MLS is described. The algorithm generates guidance commands to enable the pilot to automatically switch from RNAV to MLS and effectively correct any offset errors during this transition. Software/hardware implementation details pertinent to the TCV Boeing 737 avionics are also considered. Author

N77-24085*# Kanner (Leo) Associates, Redwood City, Calif.
METHOD AND APPARATUS TO SHUT OUT INTERFERENCE FROM THE VERTICAL COMPONENT OF THE GEOMAGNETIC FIELD IN COMPASSES AND EARTH INDUCTORS
L. Schaetz NASA Washington May 1977 14 p Transl. into ENGLISH of German patent, Verfahren und Einrichtungen zum Ausschalten storendor Einwirkungen der Vertikalkomponente des erdmagnetischen Feldes auf Kompasse, Erdinduktoren und dergl, Reichspatentamt Patentschrift no. 666 594 class 42c, Group 32.10, a 80977 IX/42 c 6 p
(Contract NASw-2790)

(NASA-TT-F-17546) Avail: NTIS HC A02/MF A01 CSCL 17G

A method and apparatus to avoid the interference of the vertical component of the earth's magnetic field in direction or course indication devices, the reading of which is determined by the direction of the horizontal component of the earth's magnetic field is described. Author

N77-24086*# Kanner (Leo) Associates, Redwood City, Calif.
STATIC, NON-SWINGING ARRANGEMENT FOR DETERMINING COURSE ON BOARD A VEHICLE
J. Devaud Washington NASA May 1977 15 p Transl. into ENGLISH of "Statische, nicht pendelnde vorrichtung zur bestimmung des kurses an bord eines fahrzeugs", Deutsches patentamt offenlegungsschrift 2 400 002, 2 Jan. 1974 18 p
(Contract NASw-2790)
(NASA-TT-F-17547) Avail: NTIS HC A02/MF A01 CSCL 17G

A static non-swinging course indicator was designed which is comprised of a three axis magnetometer, a vertical gyroscope, and a computer. The instrument is so characterized that the magnetometer has on each axis a single coil with a saturable core which is connected to a direct current proportional to the component of the magnetic field along each individual axis. Author

N77-24087# National Aviation Facilities Experimental Center, Atlantic City, N. J.
APPLICATIONS OF THE SIMULATION MODEL FOR AIR TRAFFIC CONTROL COMMUNICATIONS Interim Report, Jul. 1974 - Jul. 1975
J. Stuart Hunter and D. A. Hsu Feb. 1977 254 p refs
Prepared in cooperation with Princeton Univ.
(Contract DOT-FA72NA-741)
(AD-A036738; FAA-NA-75-180; FAA-RD-76-19) Avail: NTIS HC A12/MF A01 CSCL 17/7

The simulation program for air traffic control (ATC) communications, its structure, validation, and applications is reviewed. The model, constructed using ATC communications data from the New York Center, was checked against ATC communications data from Houston with excellent results. Studies of the applications of the model are described with respect to communications capacity and queuing, the effects of reducing the number of transmissions per transaction, the effects of tone-bursts of different duration, and the sensitivity of communication responses to changes in various input variables. The construction of general simulations for sector types, as opposed to individual sectors, is described. Queuing time analyses and forecasting for ATC communications are reported. Author

N77-24088# Systems Control, Inc., Palo Alto, Calif. Champlain Technology Industries.
TERMINAL AREA DESIGN: ANALYSIS AND VALIDATION OF RNAU TASK FORCE CONCEPTS Final Report
E. D. McConkey Oct. 1975 542 p refs
(Contract DOT-FA72WA-3098)
(AD-A037022; FAA-RD-76-194) Avail: NTIS HC A23/MF A01 CSCL 17/7

Area navigation (RNAV) terminal area design guidelines for application to medium and high density terminal areas are presented. The design concepts proposed by the FAA/Industry RNAV Task Force were utilized in the development of initial time-phased 2d terminal area designs for Chicago, Denver, Miami, New Orleans, New York, Philadelphia, and San Francisco. The time phases correspond to three time periods. The 1972 to 1977 to 19 and 1977 82 transition period design were analyzed in conjunction with a real time simulation to confirm the pilots' and controllers' capability to operate efficiently in a mixed VOR/RNAV environment. The post-1982 designs were subjected to a user economic impact analysis to determine the effects of route length and altitude restrictions on fuel and time. Two 100 percent fixed gradient VNAV designs were developed for New York and New Orleans using task force concepts and were analyzed for their impact on the user and the system. Author

N77-24089# Cutler-Hammer, Inc., Deer Park, N.Y. AIL Div.
WIDE APERTURE (DIGITAL) VOR SYSTEM, PHASE 1 Final Report
Girt C. Kundzins and Albert S. Palatnick Aug. 1976 100 p
(Contract DOT-FA73WA-3169)
(AD-A037081; A414-F; FAA-RD-76-224) Avail: NTIS HC A05/MF A01 CSCL 17/7

The design, development, and field testing of a wide aperture digital VOR system are described. The VOR ground station is in the form of 8 crossed baseline pairs of interferometers, each pair energized successively by a set of pulses and phase shifts. The airborne receiver decodes the signals from each of the interferometers. This set of measurements on each axis permits complete resolution of ambiguities and the precise calculation of the angle with respect to the station. Field tests of the feasibility model indicate it is a high performance system capable of achieving an order of magnitude improvement in both site error reduction and in accuracy compared to present VOR systems. The measured accuracies were 0.11 deg standard deviation. Author

N77-24090# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
A REVIEW AND ANALYSIS OF THE MITRE BEACON COLLISION AVOIDANCE SYSTEM Final Report, Sep. 1975 - Sep. 1976
James J. Bagnall, Jr., Lawrence R. Dausin, Irvin W. Kay, and Arthur Krinitz Oct. 1976 209 p refs
(Contract DOT-FA74WA-3498)
(AD-A037225; IDA Study S-481; FAA-RD-77-2) Avail: NTIS HC A10/MF A01 CSCL 17/7

MCAS is an active collision avoidance system which makes use of air traffic control radar beacon system (ATCRBS) transponders already installed in many aircraft. However, because the system is active, its design assumes that airborne MCAS interrogator equipment will be limited to about ten percent of the flying population in order to avoid excessive garble for its own purposes and interference with regular ATCRBS ground stations MCAS uses the same threat logic for encounters between MCAS-equipped aircraft which was recommended by ANTC-117 and its performance suffers the same deficiencies resulting from the use of that logic as predicted in previous studies. These deficiencies are a high natural alarm rate due to a lack of certain parameter data, such as bearing rate and relative acceleration, and/or less than safe alarm criteria resulting from trade-offs intended to reduce the alarm rate. For encounters with ATCRBS transponder equipped aircraft, a special, so-called remitter logic which has similar deficiencies was developed. Author

N77-24091# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary, 1 Oct. - 31 Dec. 1976
1 Jan. 1977 50 p
(Contracts DOT-FA72WAI-261; F19628-76-C-0002)
(AD-A037130; FAA-RD-77-7) Avail: NTIS HC A03/MF A01 CSCL 17/7

Analytical studies, laboratory and flight experiments, and software developments supporting the concept feasibility and performance definition phase of the FAA discrete address beacon system program are reported. Author

N77-24092# Air Force Flight Test Center, Edwards AFB, Calif.
INERTIAL NAVIGATION SYSTEMS TESTING HANDBOOKS
Larry D. Plews, Charles W. Brinkley, and Kenneth E. Reeser Jul. 1976 185 p refs
(AD-A034921; AFFTC-TIH-76-1) Avail: NTIS HC A09/MF A01 CSCL 17/7

This handbook describes the methods being used in testing an inertial navigation system at the Air Force Flight Test Center (AFFTC). Future technological advances, deviations for peculiar characteristics of individual test programs, and cost constraints may necessitate other methods being used in some cases. A background on inertial navigation systems, flight testing, and documentation of computer software developed for post-flight reduction of data is presented. Author (GRA)

N77-24093# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
SRDS TECHNICAL PROGRAM DOCUMENT: FISCAL YEAR

1977 ENGINEERING AND DEVELOPMENT APPROVED PROGRAMS
Oct. 1976 149 p
(AD-A034195) Avail: NTIS HC A07/MF A01 CSCL 17/7

The report contains Research and Technology Resumes which reflect Systems Research and Development Service, Federal Aviation Administration, approved subprograms. These resumes identify the technical objective, approach, milestones scheduled for accomplishment, end-item products, FY-76 accomplishments, and source of requirements. GRA

N77-24094# Orincon Corp., La Jolla, Calif.
NAVSTAR/GPS NAVIGATION ANALYSIS AND ALGORITHM DEVELOPMENT STUDY Final Report
Charles A. Wolfe 30 Nov. 1976 209 p refs
(Contract N00123-76-C-0564)
(AD-A034873; OC-R-76-0564-1) Avail: NTIS HC A10/MF A01 CSCL 17/7

The ultimate objective of the study is to determine a set of algorithms which can be used in a NAVSTAR/GPS user navigation system. The criteria for the acceptability of the algorithm will be the accuracy of the position and velocity determination. Since there is no way of getting real data for algorithm verification at this time, it is imperative to establish system and error models. The results of analysis of proposed algorithms is then relative to the models used. An additional objective of the entire study is that it will be a design aid. Thus it is intended that through analysis of different receiver configurations, an analytic basis for certain design decisions can be established. The final computer program for analysis will not be an interactive computer aided design tool; however, it will provide for inclusion or exclusion of certain receiver options and variability of certain parameters in order to make the analysis useful for making design decisions. GRA

N77-24095# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COVARIANCE ANALYSIS OF KALMAN FILTERS PROPOSED FOR A RADIOMETRIC AREA CORRELATOR/INERTIAL NAVIGATION GUIDANCE SYSTEM M.S. Thesis
Charles Kenneth Fitschen Dec. 1976 156 p refs
(AD-A034278; GE/EE/76D-23) Avail: NTIS HC A08/MF A01 CSCL 17/7

In this report, a covariance analysis is performed on two Kalman filters proposed for use in a weapon system utilizing a strapdown inertial navigation system (INS), updated by position data from a radiometric area correlator (RAC), for guidance. Filter performance is analyzed when primary navigation information is provided by a Sperry INS, which uses laser gyroscopes, and when an INS employing conventional dry-tuned gyroscopes, manufactured by Hamilton-Standard, is incorporated into the weapon system. For the covariance analysis, truth models in the form of linear state equations are presented which reflect the best description of the weapon system when either the Sperry or Hamilton-Standard INS is used. The Sperry system model is composed of 46 states and the Hamilton-Standard system model 61 states. Primary emphasis in this investigation is placed on minimizing system terminal navigation error. GRA

N77-24096# Army Research Inst. for the Behavioral and Social Sciences; Arlington, Va.
SPECIALIZED TRAINING VERSUS EXPERIENCE IN HELICOPTER NAVIGATION AT EXTREMELY LOW ALTITUDES
John P. Farrell and Michael L. Fineberg Nov. 1976 12 p refs
(DA Proj. 2Q7-63743-A-772)
(AD-A034732; ARI-Tech-Paper-277) Avail: NTIS HC A01/MF 01 CSCL 01/2

An experiment was performed to determine if navigation skills acquired in general flight would transfer to flight at extremely low levels and if the transfer could be matched by specialized training. Since the effects of extensive experience were matched by only 15 hours of special training, transfer may not be as extensive as previously assumed. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N77-24097*# Sikorsky Aircraft, Stratford, Conn.
STUDY TO INVESTIGATE DESIGN, FABRICATION AND TEST OF LOW COST CONCEPTS FOR LARGE HYBRID COMPOSITE HELICOPTER FUSELAGE, PHASE 2
K. M. Adams and J. J. Lucas Apr. 1977 118 p refs
(Contract NAS1-13479)
(NASA-CR-145167) Avail: NTIS HC A06/MF A01 CSCL 01C

The development of a frame/stringer/skin fabrication technique for composite airframe construction was studied as a low cost approach to the manufacturer of larger helicopter airframe components. A center cabin aluminum airframe section of the Sikorsky CH-53D, was selected for evaluation as a composite structure. The design, as developed, is composed of a woven KEVLAR R-49/epoxy skin and graphite/epoxy frames and stringers. The single cure concept is made possible by the utilization of pre-molded foam cores, over which the graphite/epoxy pre-impregnated frame and stringer reinforcements are positioned. Bolted composite channel sections were selected as the optimum joint construction. The applicability of the single cure concept to larger realistic curved airframe sections, and the durability of the composite structure in a realistic spectrum fatigue environment, was described. Author

N77-24098*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THRUST AUGMENTOR APPLICATION FOR STOL AND V/STOL
Thomas N. Aiken Jun. 1977 10 p refs
(NASA-TM-X-73241; A-7020) Avail: NTIS HC A02/MF A01 CSCL 01C

A general parametric description is suggested for thrust augmentor application to STOL and V/STOL aircraft. The parameters and their relationships are discussed using several aircraft augmentor integration problems. For a STOL transport design, the ram drag is a key consideration, limiting the maximum gross augmentation that can be utilized. Maximizing gross augmentation and balancing the aircraft are key considerations for a V/STOL fighter design. Results from wind tunnel investigations on several different thrust augmentor concepts and system studies on STOL transport designs are also included. Author

N77-24099*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD FOR MEASURING AIRCRAFT HEIGHT AND VELOCITY USING DUAL TELEVISION CAMERAS
W. Robert Young 4 Jan. 1977 18 p
(NASA-TM-X-72829) Avail: NTIS HC A02/MF A01 CSCL 01C

A unique electronic optical technique, consisting of two closed circuit television cameras and timing electronics, was devised to measure an aircraft's horizontal velocity and height above ground without the need for airborne cooperative devices. The system is intended to be used where the aircraft has a predictable flight path and a height of less than 660 meters (2,000 feet) at or near the end of an air terminal runway, but is suitable for greater aircraft altitudes whenever the aircraft remains visible. Two television cameras, pointed at zenith, are placed in line with the expected path of travel of the aircraft. Velocity is determined by measuring the time it takes the aircraft to travel the measured distance between cameras. Height is determined by correlating this speed with the time required to cross the field of view of either camera. Preliminary tests with a breadboard version of the system and a small model aircraft indicate the technique is feasible. Author

N77-24100*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT-MEASURED LIFT AND DRAG CHARACTERISTICS OF A LARGE, FLEXIBLE, HIGH SUPERSONIC CRUISE AIRPLANE

Henry H. Arnaiz Washington May 1977 62 p refs
(NASA-TM-X-3532; H-913) Avail: NTIS HC A04/MF A01 CSCL 01C

Flight measurements of lift, drag, and angle of attack were obtained for the XB-70 airplane, a large, flexible, high supersonic cruise airplane. This airplane had a length of over 57 meters, a takeoff gross mass of over 226,800 kilograms, and a design cruise speed of Mach 3 at an altitude of 21,340 meters. The performance measurements were made at Mach numbers from 0.72 to 3.07 and altitudes from approximately 7620 meters to 21,340 meters. The measurements were made to provide data for evaluating the techniques presently being used to design and predict the performance of aircraft in this category. Such performance characteristics as drag polars, lift-curve slopes, and maximum lift-to-drag ratios were derived from the flight data. The base drag of the airplane, changes in airplane drag with changes in engine power setting at transonic speeds, and the magnitude of the drag components of the propulsion system are also discussed. Author

N77-24101# Georgia Inst. of Tech., Atlanta.
HELICOPTER HOVERING PERFORMANCE STUDIES. 1: VORTEX WAKE ANALYSIS. 2: TEST FACILITY. 3: BLADE TIP PRESSURE DISTRIBUTIONS Final Technical Report, 1 Sep. 1973 - 31 Oct. 1976
Robin B. Gray, Howard M. McMahon, George T. Bird, John G. Palfery, Satish S. Samant, and T. P. Shivananda Oct. 1976 82 p refs
(Grants DA-ARO(D)-31-124-73-G184; DAAG29-76-G-0007) (AD-A034093; ARO-11630.1-E) Avail: NTIS HC A05/MF A01 CSCL 01/3

Results are presented from studies of several problem areas which are related to helicopter hovering performance prediction. A working hypothesis is described for including the tip vortex core effect in a vortex wake analysis and it is shown that the tip vortex geometry in the near wake can be calculated with good accuracy for rotors having fewer than five blades. A hovering model rotor test facility of reduced size is described. Data from this facility include measured pressure distributions on the tip of a single-bladed rotor. Author (GRA)

N77-24102# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
AN EXPERIMENTAL INVESTIGATION OF FAVORABLE INTERFERENCE EFFECTS FROM A WING AND PROPROTOR M.S. Thesis
Steven Lyttle Griffith 1976 67 p refs
(Contract DAHC04-75-C-0023; Grant DAHC04-75-G-0007)
(AD-A034075) Avail: NTIS HC A04/MF A01 CSCL 01/3

Although research on V/STOL aircraft has been extensive, there are other covertiplane configurations yet to be studied. Previous investigations of tilting proprotor concepts have considered the overall aerodynamic characteristics of specific designs. It is the purpose of this research to experimentally investigate the lift and drag characteristics of a constant-pitch proprotor and wing interaction system in the North Carolina State University subsonic wind tunnel. The testing system consisted of five basic parts, the proprotor and wing models, the North Carolina State University subsonic wind tunnel, the strain gage balance system, the system instrumentation, and the proprotor alignment, drive and shaft assembly. GRA

N77-24103# Federal Aviation Administration, Washington, D. C.
REPORT TO CONGRESS BY THE FEDERAL AVIATION ADMINISTRATION ON THE ENERGY EFFICIENCY OF AGENCY REGULATIONS Final Report
Nov. 1976 133 p
(AD-A034611) Avail: NTIS HC A07/MF A01 CSCL 10/1

All regulations and laws administered by the FAA were examined for their effect on energy consumption. An inventory of regulations requiring activities which lead to fuel usage was prepared and organized. The following general groupings were identified: (1) flight test programs; (2) environmental control; (3) aircraft fuel supply; (4) aircraft speed and flight altitude; (5) airspace and air traffic control; (6) aircraft equipment; (7) crewmember qualifications. GRA

N77-24104# McDonnell Aircraft Co., St. Louis, Mo.
TURBINE ENGINE MULTI-MISSION PROPULSION SIMULATOR WIND TUNNEL DEMONSTRATION Final Report, Jul. 1973 - 30 Oct. 1976
M. F. Eigenmann, R. L. Bear, and T. C. Chandler Wright-Patterson AFB, Ohio AFAPL Nov. 1976 350 p refs
(Contract F33615-73-C-2051; AF Proj. 668A)
(AD-A034282; AFAPL-TR-76-73) Avail: NTIS HC A15/MF A01 CSCL 21/5

A turbine engine multi-mission propulsion simulator, developed by the Air Force Aero Propulsion Laboratory (AFAPL) to permit improved aircraft performance prediction capability through the simultaneous simulation of inlet/airframe/nozzle flowfields, was successfully demonstrated in a wind tunnel model tested in the Arnold Engineering Development Center 16 ft. Transonic Tunnel. The model tested is simple, featuring the forebody, inlet and nozzle of an advanced fighter aircraft, but no wings or tail surfaces. It is adaptable to three different test modes - simulator - equipped, conventional aero flow-through and conventional jet effects, and provides for the simultaneous measurement of the total airframe, aft-end and simulator forces and moments. Extensive pressure instrumentation is also provided on the fuselage for flowfield interaction studies. Wind tunnel test data was obtained from Mach 0.6 to 1.45, and at angles of attack from -1.6 to 16 degrees. The results of the test indicate that the propulsion simulator is a viable wind tunnel test tool that can be effectively operated under realistic test conditions. Comparison of the aerodynamic performance of this configuration, as obtained from both simulator and conventional test techniques, showed relatively small differences, thereby indicating small inlet/aft-end flowfield interactions for this inlet/nozzle spacing. Data repeatability obtained with the simulator model was comparable to that obtained on the conventional models. Author (GRA)

N77-24105# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SYSTEM SIMULATION IN AIRCRAFT LANDING GEAR AND TIRE DEVELOPMENT M.S. Thesis
John Anthony Skorupa Dec. 1976 140 p refs
(AD-A034942; GAE/MC/76D-7) Avail: NTIS HC A07/MF A01 CSCL 01/2

Main gear load vs. time is predicted for an F-4E aircraft through the use of subsystem modeling and analog computation. Subsystems modeled are the aerodynamics, engine dynamics, vertical strut dynamics, fore-aft strut dynamics, tire/wheel dynamics, brake dynamics, and antiskid dynamics. The problem is restricted to a landing sequence with three degrees of freedom permitted for the aircraft. Aerodynamics are based on constant coefficients of lift, drag, and pitching moment. A drag chute is also employed. Engine dynamics are based on a linear thrust vs. velocity schedule. The strut dynamics are modeled by a mass-spring-damper system. The tire/wheel dynamics subsystem applies Newton's Second Law to derive the wheel slip ratio and ground-tire coefficient of friction. Brake dynamics are based on a schedule of brake torque vs. brake pressure. Antiskid dynamics model the Hytrol Mark II antiskid system. Stopping distances from simulation are compared to flight test data to verify the model. Results from the simulation agree with flight test data. A schedule of main gear load vs. velocity is proposed as an alternative to current tire testing practice. Author (GRA)

N77-24106# Hughes Helicopters, Culver City, Calif.
DESIGN, FABRICATION, AND TESTING OF ADVANCED COMPOSITE AH-1G TAIL SECTION (TAIL BOOM/VERTICAL FIN) Final Report, Jul. 1973 - Feb. 1976
James F. Needham Nov. 1976 164 p refs Prepared in cooperation with Fiber Sci., Inc.
(Contract DAAJ02-73-C-0079; DA Proj. 1F2-63211-DB41)
(AD-A034457; HH-76-50; USAAMRDL-TR-76-2421) Avail: NTIS HC A08/MF A01 CSCL 01/3

The purpose of this program was to design and fabricate a primary structural component for a helicopter using advanced composite materials. The component selected was the tail boom and vertical fin of the AH-1G Cobra helicopter. The composite tail boom was required to meet the existing metal tail boom structural design and stiffness criteria, and to be interchangeable with the metal tail boom. Design objectives were to reduce the life cycle costs, to minimize the parts count, and to lower the

overall weight of the existing structure. The composite tail boom successfully met the design criteria and objectives and completed all the structural and flight tests. The composite tail boom structure is a semimonocoque configuration using a sandwich wall construction. The inner and outer skins are fabricated of Thornel 300 graphite filaments with an epoxy resin, and the sandwich core is Nomex honeycomb. The wet-filament-winding technique was used in the fabrication of the major components. This research and development program established that primary helicopter components could be efficiently fabricated from composite materials. The resulting structure would have a higher fatigue strength and a lower life-cycle cost than the metal structure, and it would have an improved ballistic tolerance. Author (GRA)

N77-24107# Advisory Group for Aerospace Research and Development, Paris (France).
FLIGHT TEST TECHNIQUES
Apr. 1977 415 p In ENGLISH; partly in FRENCH Conf. Proc. of the Flight Mechanics Panel Symp., Porz Wahn, W. Germany, 11-14 Oct. 1976
(AGARD-CP-223; ISBN-92-835-0194-2) Avail: NTIS HC A18/MF A01

Techniques used in flight clearance of the basic air vehicles, including flight control systems, engines, engine-inlet systems, etc., and the externally carried weapons are described along with techniques used in weapon system development. Instrumentation systems and components, data transmission, data processing, airborne displays and computers, and real time flight test analysis and monitoring are among the topics discussed. For individual titles, see N77-24108 through N77-24132.

N77-24108# Air Force Flight Test Center, Edwards AFB, Calif.
FLIGHT CONTROL SYSTEM STRUCTURAL RESONANCE AND LIMIT CYCLE RESULTS
Paul W. Kirsten *In* AGARD Flight Test Tech. Apr. 1977 17 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Theory, testing, and results pertaining to limit cycle and structural resonance characteristics of aircraft flight control are presented. Methods for insuring that limit cycling and structural resonance do not occur unexpectedly during flight are suggested. Ground tests and inflight envelope expansion tests were used with success in the past to determine limit cycle and structural resonance characteristics. Data obtained from these tests are presented for several aircraft. Also, control system modifications made on several aircraft to eliminate control system instabilities which were uncovered through ground testing are included. Additional topics are discussed which include digital sampling effects on limit cycle characteristics, large amplitude saturation limit cycles, and pilot-in-the-loop instabilities. Author

N77-24109# Hawker Siddeley Aviation Ltd., Dunsfold (England).
FLIGHT TESTING TECHNIQUES, AUTUMN 1976
R. J. Poole *In* AGARD Flight Test Tech. Apr. 1977 17 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

A test program to demonstrate the aircraft's controllability in, and the recovery procedure from a spin formulated with reference to spinning tunnel tests is described. Data presented are gathered using the aircraft's PCM recording equipment and telemetered records observed by flight test engineers, together with the safety ground pilot, while the spins were being executed. This instrumentation together with the pilot displays and warnings in the cockpit are described. The recovery procedures to be adopted and the pilots' qualitative assessment of their effectiveness are included. Author

N77-24110# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
METHODS AND TECHNIQUES OF GROUND VIBRATION TESTING
Gerard Piazzoli *In* AGARD Flight Test Tech. Apr. 1977 9 p refs In FRENCH; ENGLISH summary (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Flight vibration tests, an important and sophisticated part of the aeroelastic research carried out for prototype clearance and certification of production aircraft, are described along with methods used for dynamic investigations of structural stability. The different techniques for delivering excitation forces, the special equipment of measurement and conditioning, and present methods of data processing and analysis are illustrated. Typical installations on aircraft of various types are described. Author

N77-24111# British Aircraft Corp., Preston (England). Military Aircraft Div.
TORNADO FLIGHT LOADS SURVEY
D. W. Altham, D. K. Potter, J. Nuscheler (Messerschmitt-Boelkow-Blohm GmbH, Munich), and W. Seidel (Messerschmitt-Boelkow-Blohm GmbH, Munich) *In* AGARD Flight Test Tech. Apr. 1977 16 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Flight loads survey instrumentation and its calibration, date acquisition and analysis techniques, and a flight test program for the TORNADO aircraft are described. Several examples of test results are given and discussed. Author

N77-24112# British Aircraft Corp., Preston (England). Military Aircraft Div.
THE EFFECT OF A COMMAND AND STABILITY AUGMENTATION SYSTEM ON FLIGHT TESTING
T. B. Saunders *In* AGARD Flight Test Tech. Apr. 1977 16 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The influence of a CSAS on flight test procedures, analysis techniques, and instrumentation requirements is discussed and is shown to be a significant factor in promoting developments in these three areas. Current handling qualities criteria are considered in relation to the CSAS. Some handling qualities requirements are written in terms that cover the introduction of major new concepts like the CSAS. Author

N77-24113# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
DEVELOPMENT FLIGHT TEST TECHNIQUES FOR DIGITAL MULTIMODE FLIGHT CONTROL SYSTEMS
David L. Carleton *In* AGARD Flight Test Tech. Apr. 1977 14 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

A technique that assesses the aircrafts' ability to allow the pilot to perform precision tracking tasks, such as air to air gunnery and air to ground weapon delivery is described. Data requirements, evaluation criteria, and examples of how the technique is used in flight test programs are included along with a discussion of merits and limitations of the technique. Author

N77-24114# British Aircraft Corp. (Operating) Ltd., Bristol (England). Commercial Aircraft Div.
FLIGHT ASSESSMENT AND DEVELOPMENT OF THE CONCORDE INTAKE SYSTEM
D. P. Morriss *In* AGARD Flight Test Tech. Apr. 1977 42 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The rapid exposure and resolution of problems were the prime objectives of the flight investigation program, devised to exploit fully the advantage of preflight prediction of potential problem areas. An account of the flight investigation, including a description of the test techniques employed, is placed in perspective by a brief recapitulation of the design of the engine air inlet system and the associated fundamental control concepts. The impact of flight investigation on the evolution of the certification standard aircraft is apparent, e.g. modification of the prototype standard wing leading edge to improve surge free negative incremental normal acceleration capability, and suppression of local reference pressure sensing for automatic air inlet control in favor of computed reference signals derived from central air data sources. In similar contex the clear emergence of the necessity to place reliance on flight test data as the basis of formulation of the production standard air inlet control system functional laws, is of paramount significance. Flight determination of the sensitivity of engine surge thresholds and hence the effective maneuver, Mach Number, and throttling limits, to systematic variation of inlet geometry proved to be essential. The delicate balance between the requirements of performance, inlet/engine compatibility, and simplicity of crew management, dictated by

considerations of commercial viability, was achieved by the air inlet control system laws so derived. Author

N77-24115# Royal Aircraft Establishment, Farnborough (England).
WEAPONS TESTING TECHNIQUES
F. J. Bigg, N. Tait (Cape Engineering Ltd., Warwick, Eng.), and D. A. Williams (Cranfield Inst. of Technology) *In* AGARD Flight Test Tech. Apr. 1977 13 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The philosophy adopted by the Directorate of Air Armament MOD (PE) United Kingdom and the Air Armaments Department, Royal Aircraft Establishment, Farnborough in obtaining experimental information relevant to the design and clearance of free fall weapons and associated carriage equipment is described. A number of instrumented stores which were developed as a result are described in some detail, and the conclusions are presented. Author

N77-24116# National Gas Turbine Establishment, Pyestock (England).
SUPERSONIC POWERPLANT TESTING FOR PREFLIGHT PERFORMANCE EVALUATION
G. G. Annear *In* AGARD Flight Test Tech. Apr. 1977 12 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The facilities used to evaluate the performance at supersonic speeds of complete propulsion units, (inlet, engine and exhaust system) is described. The way in which ground level test bed data are used to predict flight performance, and how the prediction may be refined by the use of altitude Cell data are discussed. Author

N77-24117# National Gas Turbine Establishment, Pyestock (England).
PROCEDURES FOR THE MEASUREMENT OF ENGINE THRUST IN FLIGHT
J. C. Ascough *In* AGARD Flight Test Tech. Apr. 1977 19 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

General principles of thrust and drag accounting are discussed, the essential fluid flow relationships on which measurements are based are presented, and the necessary testing of model components and full scale engine is indicated. A strong emphasis in placed upon error estimation and thrust option management. Author

N77-24118# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
ESTIMATION OF DRAG AND THRUST OF JET-PROPELLED AIRCRAFT BY NON-STEADY FLIGHT TEST MANEUVERS
J. A. Mulder and J. M. VanSliedregt *In* AGARD Flight Test Tech. Apr. 1977 30 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

When measuring aircraft performance or lift-drag characteristics in steady or nonsteady flight numerical apriori information is required from engine (altitude) test facilities for an accurate determination of engine thrust. It is shown that this need for apriori information may be eliminated by an inflight calibration of the measuring probes for engines gross thrust and mass flow simultaneously with the measurement of the aircraft lift-drag characteristics. Results are presented of 9 nonsteady flight test maneuvers with a Hawker Hunter mk VII jet aircraft at 10.000, 20.000, and 30.000 ft nominal flight altitude. Besides lift-drag characteristics and engine gross thrust and mass flow calibration factors, several alternative performance characteristics as excess thrust in horizontal flight and also stability and control characteristics may be deduced from the measurements. The validity of the flight test results, in particular with respect to the inflight calibration of the gross thrust and mass flow measuring probes is, because of the particular aircraft exploited for the flight tests, restricted to the case of a socalled straight jet engine configuration and a non-flexible aircraft. Author

N77-24119# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
FLIGHT TESTING AND EVALUATION TECHNIQUES FOR THE DETERMINATION OF HANDLING QUALITIES
Horst Wuennenberg and Ulrich VonMeier *In* AGARD Flight Test Tech. Apr. 1977 13 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The techniques of handling qualities determination in flight testing are discussed. The main targets for flight testing are described and examples from the Alpha Jet flight testing are presented. It is proposed to present the necessary information for flight manual and certification documentation (pilot comments, flight test evaluation, and theoretical calculations) in table form. Author

N77-24120# Air Force Flight Test Center, Edwards AFB, Calif.
A MISSION ORIENTED FLIGHT TEST TECHNIQUE FOR IDENTIFYING AIRCRAFT AND FLIGHT CONTROL SYSTEM TRANSFER FUNCTIONS
Thomas R. Twisdale, Gerald L. Jones, and Tice A. Ashurst *In* AGARD Flight Test Tech. Apr. 1977 14 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Data analysis techniques were developed at the Air Force Flight Test Center (AFFTC) which offer unique and quantitative insights into pilot-in-the-loop handling qualities. These data analysis techniques, called System Identification From Tracking (SIFT), are based on time series analysis procedures. These procedures are used to perform a frequency domain evaluation of data obtained during closed-loop, mission oriented precision tracking maneuvers. Normal stability and control test parameters are measured and recorded in the time domain during the maneuver. As many as four of these parameters are selected as multiple inputs to the system being evaluated and one parameter is selected as the system response. These time domain data are Fourier transformed into the frequency domain, where spectral content, multiple frequency response transfer functions, and coherence functions are estimated and plotted. Depending on the parameters selected for analysis, either the flight control system (or its components), or the airframe aerodynamics, or the total system characteristics (control system plus aerodynamics) may be identified. Interim results show that, for the aircraft being analyzed, lateral-directional coupling into the pitch axis has an unexpected and apparently significant impact on longitudinal handling qualities, even for small angles of attack and sideslip. Author

N77-24121# Air Force Flight Test Center, Edwards AFB, Calif. Systems Engineering Branch.
OVERALL AIRCRAFT SYSTEMS EVALUATION
Frank N. Lucero and Charles E. Adolph *In* AGARD Flight Test Tech. Apr. 1977 13 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The managerial and test procedures used by personnel at the Air Force Flight Test Center to plan, conduct, and report on overall aircraft systems test programs are described. Author

N77-24122# National Aerospace Lab., Amsterdam (Netherlands).
DETERMINATION OF ANTENNA RADIATION PATTERNS, RADAR CROSS SECTIONS AND JAM-TO-SIGNAL RATIOS BY FLIGHT TESTS
O. B. M. Pietersen, G. J. Alders, and R. B. A. Wasch *In* AGARD Flight Test Tech. Apr. 1977 6 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

A data acquisition and processing method, aimed at the determination of radiation patterns of airborne equipment is described. The data acquisition procedure and, more specific, the data processing and presentation schemes used are emphasized. Author

N77-24123# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. Fuer Flugfuehrung.
REAL TIME DATA TRANSMISSION AND PROCESSING FOR THE DETERMINATION OF AIRCRAFT ANTENNA RADIATION PATTERNS
Helmut Bothe *In* AGARD Flight Test Tech. Apr. 1977 11 p

refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

A measuring system determining aircraft antenna radiation patterns in flight is described. Measuring system requirements and configuration are outlined. Real time data processing and quick-look monitoring during flight tests are enabled by a telemetry system, the state of which is described. Author

N77-24124# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
HYBRID REFERENCE SYSTEMS FOR FLIGHT TESTING
Heinz Winter and Ulrich Brokof *In* AGARD Flight Test Tech. Apr. 1977 15 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Hybrid reference systems consisting of ground-based measuring equipment (tracking radar, long sitance radar) and on-board sensors (Doppler or inertial navigation systems) were analyzed with respect to the accuracy of position, velocity, and attitude measurement. Flight experiments demonstrated that the high accuracies required for weapon guidance systems testing can be obtained with such systems. Author

N77-24125# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
FLIGHT TESTING OF DISPLAYS IN A HELICOPTER
R. Beyer *In* AGARD Flight Test Tech. Apr. 1977 11 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Electro-optical sensors and electronic displays for a future helicopter avionics system may extend the flexibility of helicopter operation at night and in bad weather. Flight tests were made with a simulated system which presented a combination of flight instruments and an image of the terrain to the pilot. Means were developed to assess flight performance and pilot strain in flights with the system and some of the measures and the results obtained are discussed. Author

N77-24126# Royal Aircraft Establishment, Farnborough (England). Dept. of Instrumentation and Trials.
ANGULAR MOTION SENSING WITH GAS ROTORS
W. R. MacDonald *In* AGARD Flight Test Tech. Apr. 1977 26 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Angular motion transducers based on a gas rotor are discussed. These exploit the fact that when a coil of tube containing gas experiences angular acceleration, a pressure proportional to the acceleration is generated. The pressure is measured by a capacitive membrane sensor and depending on the design characteristics, outputs representing angular acceleration, vibratory angular displacement, or vibratory angular velocity may be obtained. The design and performance of these three types of transducer are discussed in detail and examples of practical instruments are given. Gas rotor transducers display characteristics similar to those of rotary spring-mass systems, but they are effectively devoid of moving parts and in principle are perfectly balanced. They are therefore potentially cheap and very robust. Moreover, since the rotor can be of any convenient shape, optimum use can be made of available space and multi-axis instruments of similar size to their single-axis counterparts are feasible. Author

N77-24127# Centre d'Essais en Vol, Istres (France).
EXAMPLES OF LASER UTILIZATION IN CIVIL AIRCRAFT CERTIFICATION TESTS
Nicolas Lapchine *In* AGARD Flight Test Tech. Apr. 1977 20 p refs In FRENCH (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The STRADA system installed at the Brittany Flight Test Center was used in flight certification tests of the Concorde and Mercure 100 aircraft. The system uses optical radar (LIDAR) mounted on a turret, consisting of a yttrium-aluminum yag laser transmitting in the infrared at a frequency of 3200 impulses per second. The luminous energy received by passive retroreflectors mounted on the aircraft is received in an optical reception system linked to two receivers which measure distance and angle variations. A computer is used for real time calculation of the trajectory of the reflectors mounted on the aircraft. Tests for both the Concorde and the Mercure flights are described.
Transl. by A.R.H.

N77-24128*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TELEMETRY AND DATA RELAY FOR MANNED SPACE PROGRAMS
Kim W. Anson *In* AGARD Flight Test Tech. Apr. 1977 14 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

Previously and currently planned methods of transferring or relaying telemetered information from a remote receiving station to the Mission Control Center, at the National Aeronautics and Space Administration Lyndon B. Johnson Space Center, are discussed. The data flow techniques of the Apollo Program (fixed formats), the Skylab Program (data compression), and the Space Shuttle Program (data throughput) are defined and analyzed according to their advantages and deficiencies from an operations viewpoint. Excluded from the data flow technique discussions are command data, tracking data, television data, and Teletype and Datafax messages. Voice transmissions are addressed in the Space Shuttle Program discussion because they form a part of the telemetry data stream. The tradeoffs between actual data flow requirements and existing communications limitations are addressed for each of these programs. Finally, a short discussion of current problem areas in the planned ground data transmission system for the Space Shuttle Program is presented. Author

N77-24129# Boeing Aerospace Co., Seattle, Wash.
RESORS: A SYSTEM FOR ON-LINE, ON-BOARD DATA REDUCTION AND PERFORMANCE ANALYSIS DEVELOPED ESPECIALLY FOR E-3A FLIGHT TESTS
H. A. Williams *In* AGARD Flight Test Tech. Apr. 1977 13 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

A system of computer programs (RESORS) to analyze radar report data using an interactive graphics terminal is described. Developed for E-3A test flights, RESORS permits on-board, on-line engineering judgemental decisions in data reduction and analysis. With RESORS, complex multi-dimensioned data can be displayed and sorted in any pair of twenty or so dimensions assisting in immediate decisions affecting test conduct and control. Primary functions include a quick look at flight results, isolation of identifiable radar reports such as tracks, detection of radar anomalies, and determination of false alarm rates. The program flexibility provides both detailed analysis capability, and a big picture overview of flight test data. Author

N77-24130*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AN ADVANCED AIRBORNE DATA ACQUISITION SYSTEM
Febo Bartoli *In* AGARD Flight Test Tech. Apr. 1977 12 p refs (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The development and features of and user experience with an advanced airborne data acquisition system are described. The system consists of as many as 16 high speed pulse code modulation data acquisition units which are integrated with an airborne computer and a cockpit display unit. The data acquisition units may be operated without the computer. Operation without the computer is termed stand-alone operation. Computer integrated operation is intended for large-scale projects, and stand-alone operation is designed for small-scale projects. The cockpit display unit, which is part of the computer operated system, displays computed real time data in engineering units. An example of the cost reduction experienced by a major aircraft company by using the advanced data acquisition system is given. Author

N77-24131# Boeing Commercial Airplane Co., Seattle, Wash.
USE OF ONBOARD REAL-TIME FLIGHT TEST ANALYSIS AND MONITOR SYSTEMS Progress Report
William S. Lieberman *In* AGARD Flight Test Tech. Apr. 1977 10 p (For primary document see N77-24107 15-05)

Avail: NTIS HC A18/MF A01

The actual usage of onboard real time computer controlled data analysis systems during the recent flight test programs for two different Boeing model aircraft, and the plans for use in future application are described. The results of such usage have been the shortening in schedule flow time and cost of the programs, as well as the increased accuracy of results and reduction in post-flight batch data processing. They have also reduced the dependency on geographical location of the test area since down link telemetry systems are not required. Author

N77-24132# Air Force Flight Test Center, Edwards AFB, Calif.
THE AUTOMATED FLIGHT TEST DATA SYSTEM
Charles O. Johnson and Paul J. Sehnert *In* AGARD Flight Test Tech. Apr. 1977 17 p (For primary document see N77-24107 15-05)
Avail: NTIS HC A18/MF A01

The United States Air Force, Air Force Flight Test Center Automated Flight Test Data System (AFTDS), a derivative of the Grumman real time system, was extensively used by the B-1 development test program, was used to a lesser degree for the F-5E spin evaluation, and has considerable use planned during the F-16 full scale development tests. The applications range from simple real time validation of instrumentation system health to presentation of engineering data such as drag polars, load analysis, and terrain following/terrain avoidance system information. A system that employs on-line computation to generate real time engineering data is also described. Interfaces with the onboard instrumentation system, the planning activity required to effectively apply this data system, description and presentation of typical data analyses packages, consideration of the limitations, benefits, and indication of future plans are covered in greater detail. Author

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-24133*# Systems Control, Inc., Palo Alto, Calif.
CIVIL MINI-RPA'S FOR THE 1980'S: AVIONICS DESIGN CONSIDERATIONS Final Report, Jan. - Jun. 1975
J. S. Karmarkar Jul. 1975 63 p refs
(Contract NAS2-7747)
(NASA-CR-127679) Avail: NTIS HC A04/MF A01 CSCL 01D

A number of remote sensing or surveillance tasks (e.g., fire fighting, crop monitoring) in the civilian sector of our society may be performed in a cost effective manner by use of small remotely piloted aircraft (RPA). This study was conducted to determine equipment (and the associated technology) that is available, and that could be applied to the mini-RPA and to examine the potential applications of the mini-RPA with special emphasis on the wild fire surveillance mission. The operational considerations of using the mini-RPA as affected by government regulatory agencies were investigated. These led to equipment requirements (e.g., infra-red sensors) over and above those for the performance of the mission. A computer technology survey and forecast was performed. Key subsystems were identified, and a distributed microcomputer configuration, that was functionally modular, was recommended. Areas for further NASA research and development activity were also identified. Author

N77-24134# Illinois Univ., Urbana-Champaign. Savoy Aviation Research Lab.
ADVANCED INTEGRATED AIRCRAFT DISPLAYS AND AUGMENTED FLIGHT CONTROL Final Scientific Report, 1973 - 1976
Stanley N. Roscoe Nov. 1976 42 p refs
(Contract N00014-76-C-0081)
(AD-A034817; ARL-76-17/ONR-76-4) Avail: NTIS HC A03/MF A01 CSCL 01/4

The Aviation Research Laboratory of the University of Illinois has investigated integrated computer-generated symbolic displays and computer-augmented flight control for the Office of Naval Research. The research was directed toward (1) the isolation of minimum sets of visual image cues sufficient for spatial and geographic orientation in the various ground-referenced phases of representative flight missions, (2) the generation and spatially integrated presentation of computed guidance commands and fast-time flight path predictors, and (3) the matching of the dynamic temporal relationships among these display indications for compatibility with computer-augmented flight performance control dynamics, both within each ground-referenced mission phase and during transitions between phases. The investigative program drew selectively upon past work done principally under ONR sponsorship or partial sponsorship, including the ANIP and JANAIR programs. Author (GRA)

N77-24135# Army Electronics Command, Fort Monmouth, N.J.
DIGITAL GENERATION OF CONTOUR MAPS FOR RASTER SCAN DISPLAY
Victor Vajo Dec. 1976 57 p
(DA Proj. 1F2-62202-AH-85)
(AD-A034663; ECOM-4454) Avail: NTIS CSCL 17/7

This report is concerned with the development of a digitally generated contour map to be displayed on standard raster TV for use in Army aircraft. The requirement for a display of this type is generated by the operations of Army aircraft in nap-of-the-earth (NOE) flight during both day and night operation. NOE flight in this case refers specifically to pilotage at or below tree top level. The study proved the feasibility of generating digital contour maps for display on standard TV monitors. Computer programs were written in assembly language for the Singer SKC-2000 Airborne Computer which generate two color (black and white) contour maps for display on a standard 525 line television system. GRA

N77-24136# Air Force Academy, Colo.
HELMET MOUNTED DISPLAYS AS AN ALTERNATE SOURCE OF FLIGHT INFORMATION Final Report
Eugene H. Galluscio, John E. Rasinski, and Robert G. Eggleston Jan. 1977 32 p refs
(AD-A034724; USAFA-TR-77-1) Avail: NTIS HC A03/MF A01 CSCL 01/2

The potential use of Helmet Mounted Displays (HMD) as an alternate source of flight information was examined. Air Force T-41 instructor pilots were trained to perform two complex flight maneuvers in a GAT 1 flight simulator using a monocular visor-projected display as the sole source of aircraft flight information. A search pattern and weapons delivery maneuver were flown utilizing standard aircraft instruments. The pilot flew the maneuvers under four experimental conditions: (1) referencing the simulator instruments only, (2) referencing the simulator instruments with selected instruments occluded, (3) referencing the helmet display only, (4) referencing the helmet display with selected instruments occluded. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N77-24137*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTERIOR AND EXTERIOR FUSELAGE NOISE MEASURED ON NASA'S C-8A AUGMENTOR WING JET-STOL RESEARCH AIRCRAFT
Michael D. Shovlin Apr. 1977 50 p refs
(NASA-TM-X-73235; A-7012) Avail: NTIS HC A03/MF A01 CSCL 20A

Interior and exterior fuselage noise levels were measured on NASA's C-8A Augmentor Wing Jet-STOL Research Aircraft

in order to provide design information for the Quiet Short-Haul Research Aircraft (QSRA), which will use a modified C-8A fuselage. The noise field was mapped by 11 microphones located internally and externally in three areas: mid-fuselage, aft fuselage, and on the flight deck. Noise levels were recorded at four power settings varying from takeoff to flight idle and were plotted in one-third octave band spectra. The overall sound pressure levels of the external noise field were compared to previous tests and found to correlate well with engine primary thrust levels. Fuselage values were 145 + or - 3 dB over the aircraft's normal STOL operating range. Author

N77-24138*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INLET REYNOLDS NUMBER AND TEMPERATURE EFFECTS ON THE STEADY-STATE PERFORMANCE OF A TFE731-2 TURBOFAN ENGINE

George A. Bobula and Roy A. Lottig Washington May 1977 51 p refs Prepared in cooperation with the US Army Air Mobility R and D Lab., Cleveland

(NASA-TM-X-3537; E-8941) Avail: NTIS HC A04/MF A01 CSCL 21E

Effects of varying engine inlet Reynolds number index (0.75, 0.50, 0.25, and 0.12) and temperature (289 and 244 K) on a TFE731-2 turbofan engine were evaluated. Results were classified as either compression system effects or effects on overall performance. Standard performance maps are used to present compression system performance. Overall performance parameters are presented as a function of low rotor speed corrected to engine inlet temperature. Author

N77-24139*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYTICAL PREDICTION OF THE PERFORMANCE AND STABILITY OF A J85-13 COMPRESSOR WITH DISTORTED INLET FLOW

Edward J. Milner Washington May 1977 31 p refs

(NASA-TM-X-3515; E-8887) Avail: NTIS HC A03/MF A01 CSCL 21E

The parallel compressor concept was studied using a compressor model based on the overall clean-inlet performance map obtained from experimental tests in an altitude chamber using a General Electric J85-13 turbojet engine. The model, which includes a static-pressure balance calculation at compressor discharge, was exercised at conditions corresponding to 10 different screen-induced distortion patterns included in the experimental data base. The spoiled area of these patterns ranged from 30 deg to 180 deg, and the distortion screen density, or the area blocked by the screen wire per unit area of screen, varied from 26 to 69 percent. The study indicates that at the higher corrected speeds, the analytical surge lines obtained are good representations of the correspondending experimental surge lines and are independent of distortion angle or distortion angle or distortion level. Author

N77-24140*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF HIGH-AREA-RATIO ANNULAR DUMP DIFFUSER USING SUCTION-STABILIZED-VORTEX FLOW CONTROL

Albert J. Juhasz and John M. Smith Washington May 1977 41 p refs

(NASA-TM-X-3535; E-9011) Avail: NTIS HC A03/MF A01 CSCL 21E

A short annular dump diffuser having a geometry conductive to formation of suction stabilized toroidal vortices in the region of abrupt area change was tested. The overall diffuser area ratio was 4.0 and the length to inlet height ratio was 2.0. Performance data were obtained at near ambient temperature and pressure for inlet Mach numbers of 0.18 and 0.30 with suction rates ranging from 0 to 18 percent of total inlet mass flowrate. Results show that the exit velocity profile could be readily biased toward either wall by adjustment of inner and outer wall suction rates. Symmetric exit velocity profiles were inherently unstable with a tendency to revert to a hub or tip bias. Diffuser effectiveness was increased from about 38 percent without suction to over 85 percent at a total suction rate of 10 to 12 percent. At the same time diffuser total pressure loss was reduced from 3.1 percent to 1.1 percent at an inlet Mach number of 0.3. Author

N77-24141*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NOISE OF FAN DESIGNED TO REDUCE STATOR LIFT FLUCTUATIONS

James H. Dittmar, Richard P. Woodward, and Edward G. Stakolich Washington May 1977 47 p refs

(NASA-TM-X-3538; E-8986) Avail: NTIS HC A03/MF A01 CSCL 20A

An existing fan stage was redesigned to reduce stator lift fluctuations and was acoustically tested at three nozzle sizes for reduced noise generation. The lift fluctuations on the stator were reduced by increasing the stator cord, adjusting incidence angles, and adjusting the rotor velocity diagrams. Broadband noise levels were signficantly reduced in the middle to high frequencies. Blade passage tone sound power was not lessened, but decreases in the harmonics were observed. Aerodynamic improvements in both performance and efficiency were obtained. Author

N77-24142# European Space Agency, Paris (France).

INFLUENCE OF LEADING EDGE RADIUS ON THE PERFORMANCE OF HIGHLY DEFLECTED STATOR CASCADES

J. Paulon Mar. 1977 22 p refs Transl. into ENGLISH from Assoc. Tech. Maritime et Aeron., Bull. no. 73, 1973 p 485-503 Original report in FRENCH previously announced as 74A19686

(ESA-TT-362; ONERA-TP-1237) Avail: NTIS HC A02/MF A01

An experimental facility, which includes an inducer producing swirl in the flow in an annular channel between two coaxial cylinders, was used to study axial compressor stator blade profiles. These form a fixed annular cascade and the performances in compression, deflection, and efficiency are measured at the mid-radius. This facility is very flexible in operation since, by varying the supply total pressure, it allows a wide range of Mach numbers to be investigated between 0.30 and 0.80 (0.80 corresponds closely to the choking of the cascade studied). Furthermore, the angle of attack, and hence the incidence, can be varied over a range of about 12 deg by changing the inducer (5 inducers are used). The performances obtained with this cascade show that off-design losses are governed by the leading-edge radius which is thus seen to be an important parameter. Tests performed with the same blades, given a progressively rounded leading edge, show that although the performances in compression ratio and total pressure recovery remain practically unaffected near the design condition, a small leading-edge radius improves the deflection performance. A simple empirical formula correlating the experimental results is given which allows a grouped arrangement of the losses obtained. This might be useful in research to find an optimum stator as a function of the Mach number and the incidence. Author (ESA)

N77-24143# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

F100 MULTIVARIBLE CONTROL SYSTEM ENGINE MODELS/DESIGN CRITERIA Final Report, 1 Jun. 1975 - 31 Aug. 1976

Ronald J. Miller and Ronald D. Hackney Nov. 1976 135 p refs

(Contract F33615-75-C-2048; AF Proj. 3066)

(AD-A033532; FR-7809; AFAPL-TR-76-74) Avail: NTIS HC A07/MF A01 CSCL 21/5

The objective of the F100 multivariable Control research program is to extend the linear quadratic regulator (LQR) theory to develop a 'practical' control system that can operate a state-of-the-art gas turbine engine over its entire flight envelope. The engine selected for this program is a Pratt and Whitney Aircraft F100 afterburning turbofan. To determine the adequacy of the control synthesis effort, the resulting control logic will be incorporated into a digital computer/controller, which then will be used to control a F100 engine in an altitude test facility at NASA Lewis Research Center. The F100 engine computer simulations, the control criteria for defining the basic requirements of a F100 control system, and a brief evaluation of the resulting LQR engine control system are presented in this report. GRA

N77-24144# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
WATER INGESTION INTO AXIAL FLOW COMPRESSORS Final Report, 1 Apr. 1975 - 31 Aug. 1976
S. N. Murthy, B. A. Reese, C. L. Abernathy, and G. T. Arcangeli Wright-Patterson AFB, Ohio AFAPL Aug. 1976 128 p refs (Contract F33615-74-C-2014)
(AD-A033611; M-WPAFB-T-76-1; AFAPL-TR-76-77) Avail: NTIS HC A07/MF A01 CSCL 21/5

The problem of the flow of a gas-liquid mixture through a multi-stage axial compressor orginially designed for air flow arises during take-off from a rough runway with water on it and during rain. Preliminary investigations have revealed the problem areas in the fan, L.P., and H.P. compressor stages. The basic aerothermodynamic equations have been deduced in a form suitable for considering development of a computational program.
Author (GRA)

N77-24145# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF AN AIRJET DISTORTION GENERATOR USED TO PRODUCE STEADY-STATE, TOTAL-PRESSURE DISTORTION AT THE INLET OF TURBINE ENGINES Final Report, 16 Oct. 1975 - 4 Feb. 1976
B. W. Overall AEDC Dec. 1976 82 p refs Sponsored by Air Force
(AD-A033883; ARO-ETF-TR-76-91; AEDC-TR-76-141) Avail: NTIS HC A05/MF A01 CSCL 21/5

A performance evaluation of an airjet distortion generator system used to produce steady-state, total-pressure distortion at the inlet to a turbine engine was conducted. The capability of the system to duplicate screen-generated, parametric distortion patterns (180 deg, one per revolution; tip radial; hub radial) and to maintain a constant composite distortion pattern over a range of airflows is presented. A comparison of the effect of inlet distortion produced by screens to that produced by the airjet distortion generator system on the stability characteristics of a present-day turbofan engine is described. Author (GRA)

N77-24146# Defense Systems Management School, Fort Belvoir, Va.
IMPROVING JET ENGINE RELIABILITY AND MAINTAINABILITY: A CONCEPTUAL APPROACH
John D. Masson 5 May 1976 47 p refs
(DSMS Proj. PMC-76-1)
(AD-A033815) Avail: NTIS HC A03/MF A01 CSCL 21/5

The purpose of this report is to propose a management approach to be used to improve jet engine reliability and maintainability. The need for improvement is established through an examination of the life cycle of an engine, the estimated costs, costs associated with each life cycle phase, and the factors occurring during each phase that significantly affect reliability and maintainability. This review concludes that significant changes to the engine development and acquisition changes are not practical. The proposed approach is intended for use within the existing engine life cycle framework. GRA

N77-24147# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
INTERNAL AERODYNAMICS, HEAT TRANSFER AND HIGH TEMPERATURE MATERIALS IN AIR-BREATHING ENGINES Final Report, 20 Sep. 1968 - 30 Jun. 1976
W. Tabakoff Oct. 1976 74 p
(Contract DAAG29-69-C-0016)
(AD-A033668; Rept-76-50; ARO-T-4.78-E) Avail: NTIS HC A03/MF A01 CSCL 21/5

The research presented is concerned with improving the performance of air-breathing propulsion systems. Theoretical and experimental studies of basic phenomena upon which the performance is dependent, were carried out. These studies covered the following areas: (1) particulate flows in propulsion systems; (2) cascade aerodynamics; (3) jet mixing flow; (4) high temperature materials; and (5) gas turbine blades and combustion chambers heat transfer. Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-24148# European Space Agency, Paris (France).
STABILIZATION, GUST ALLEVIATION AND ELASTIC MODE CONTROL FOR AN AIRCRAFT MODEL MOVING IN THE WIND TUNNEL
Gernot Hoffmann Apr. 1977 150 p refs Transl. into ENGLISH of 'Stabilisierung, Boenkompensation u. Schwingungsdaempfung am elastischen, beweglichen Flugzeugmodell im Windkanal', DFVLR, Brunswick Report DLR-FB-76-44, DFVLR, Brunswick Report DLR-FB-76-44, 11 Aug. 1976 Original report in GERMAN previously announced as N77-17104 Original German report available from DFVLR, Cologne DM 49.60
(ESA-TT-359; DLR-FB-76-44) Avail: NTIS HC A07/MF A01

For an elastic aircraft model which can move in the wind tunnel with several degrees of freedom, the development and practical test of a multivariable controller is discussed. The controller stabilizes the elevation and the pitch angle, alleviates vertical gusts, and improves the damping of the first elastic mode. The control system synthesis depends on principles of optimization and simulation in the state space. Some low order linear filters are needed to meet the technical conditions.
Author (ESA)

N77-24149# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
COMPARISON OF SEVERAL MODELS DESCRIBING THE GUST LOADS ON AIRCRAFT STRUCTURES
O. Buxbaum and J. M. Zaschel 1976 50 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verkehr
(LBF-TB-130/76) Avail: NTIS HC A03/MF A01

Two gust models and their application in airworthiness regulations are described. Their suitability in determining static and fatigue strength of aircraft structures was investigated. The models considered were: discrete gust model based on a sequence of single isolated gusts, and a model of continuous turbulence accounting for turbulence as a stochastic process. The model of continuous turbulence was shown to improve the description of gust loads and the prediction of dynamic response, presuming that the statistical distribution of gust velocities and the transfer function of the aircraft under consideration are known. ESA

N77-24150# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
AIR CUSHION VEHICLE GROUND CONTACT DIRECTIONAL CONTROL DEVICES Special Report
Gunars Abele and Ronald A. Liston Dec. 1976 25 p refs
(DA Proj. 4A1-61101-A-91D)
(AD-A034825; CRREL-SR-76-45) Avail: NTIS HC A02/MF A01 CSCL 01/3

The maneuverability of air cushion vehicles can become a serious operational problem when the vehicle's travel route is restricted by obstacles, slopes or cross-wind conditions, or when close-quarter turns are required. While improvement and perfection of aerodynamic methods may be a more desirable approach, there is a practical limit to these methods, and the use of ground contact devices requires consideration for providing more positive directional control. Wheels deserve special attention, and therefore are analyzed in more detail because of their obvious application on a variety of land terrains. Brake rods and harrows are more suitable on water, ice, and snow. The saucer-shaped ground contact device would cause the least ecological impact on fragile organic terrains such as tundra. Relative directional stability is evaluated in terms of the total yawing moments produced by wheel arrangements (single, dual, tandem), location on the vehicle, and operational modes (free-rolling, braked, or a combination of the two). The available moments are plotted against the yaw angle of the vehicle to determine the most effective operational mode with a particular wheel arrangement for any yaw condition. The analysis is limited to retractable devices which act as moment producing brakes or rollers and do not serve as either propulsion or load support aids. Controlled ground contact with skirt sections having special wearing surfaces may provide a suitable control

method and would require the least significant change to the basic design of the vehicle or its components. The concept involves the use of an air flow control mechanism for deflating specific skirt sections. GRA

N77-24151# General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.
CONTROL POWER CRITERIA FOR STATICALLY UNSTABLE AIRCRAFT Final Report
Nov. 1976 71 p
(Contract N00019-75-C-0355)
(AD-A033969; CASD-NSC-76-003) Avail: NTIS HC A04/MF A01 CSCL 01/3

The sensitivity of control power requirements during gust response to variations in aircraft parameters and input disturbance levels has been investigated in an attempt to provide data useful in establishing design criteria and margins of safety needed in the control of aerodynamically unstable aircraft. Both canard configured and a conventional tail configured aircraft were used in this study. For both configurations the critical flight conditions were during the low-speed power approach. The critical gust frequency in terms of critical power requirement for a (1-cos) type gust was approximately twice the closed loop natural frequency of the aircraft. Static margin was found to be the primary quantity influencing the control power requirements. The sensitivity of required control power to variation in other aircraft parameters is predictable by the manner in which these parametric variations alter the static margin. The high angle of attack characteristics also had a significant effect on the control power requirements - indicating the need for a complete and accurate data base in this region. The gust upset boundaries dropped off sharply when the discrete gust was applied at a significant angle from the vertical. The control power requirements were found to be relatively insensitive to variations in the discrete gust mode shape in the absence of control surface rate saturation. Likewise, the increases in required control power due to increased gust magnitude were also relatively small when the surfaces were not rate saturated. When rate limits were reached, however, discrete gust magnitude and shape became more significant and those gust shapes that caused the longest periods of rate saturation were most critical. GRA

N77-24152# Air Force Academy, Colo. Frank J. Seiler Research Lab.
DECOUPLING CONTROL OF SYSTEMS WITH UNCERTAIN PARAMETERS DEFINED OVER A DISCRETE RANGE
Robert B. Asher and Robert J. Mulholland Dec. 1976 24 p refs
(AD-A034397; FJSRL-TR-76-0021) Avail: NTIS HC A02/MF A01 CSCL 01/3

The problem of decoupling of systems with parameter uncertainty is treated. The possible parameter values are defined over a discrete range. The conditions for decoupling are given as well as for disturbance isolation. Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N77-24153*# Old Dominion Univ., Norfolk, Va.
EVALUATION OF HYDROGEN AS A CRYOGENIC WIND TUNNEL TEST GAS Final Report
Richard C. Haut Apr. 1977 159 p refs
(Grant NGR-47-003-052)
(NASA-CR-145186) Avail: NTIS HC A08/MF A01 CSCL 14B

The nondimensional ratios used to describe various flow situations in hydrogen were determined and compared with the corresponding ideal diatomic gas ratios. The results were used to examine different inviscid flow configurations. The relatively high value of the characteristic rotational temperature causes the behavior of hydrogen, under cryogenic conditions, to deviate substantially from the behavior of an ideal diatomic gas in the compressible flow regime. Therefore, if an idea diatomic gas is to be modeled, cryogenic hydrogen is unacceptable as a wind tunnel test gas in a compressible flow situation. Author

N77-24154# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
USAGE OF LANDING MAT AS OVERLAY ON ASPHALT RUNWAY DURING MILITARY FIELD EXERCISES Final Report
Hugh L. Green Dec. 1976 77 p refs
(AD-A033914; WES-MP-S-76-24) Avail: NTIS HC A05/MF A01 CSCL 01/5

This report describes four military exercises conducted at Oak Grove, N. C., in which XM18 landing mat was placed over a deteriorating asphalt runway to provide a landing strip for C-130 cargo aircraft. In the past, studies had been conducted at the WES on this subject; however, this was the first opportunity to gain firsthand knowledge on the behavior of the aircraft and the landing mat during a field exercise. This report is based on Memorandums for Record (MFR's) prepared for each of the exercises, which were conducted over a four-year period. Details of each exercise are described in the MFR's, which are presented in their entirety as appendixes in this report. The lessons learned that may be helpful in future installations of landing mat over asphalt are listed in the form of conclusions and recommendations. This report should prove to be a valuable aid to a unit commander responsible for installation of landing mat over asphalt pavement. GRA

N77-24155# Calspan Corp., Buffalo, N.Y.
INTERFERENCE-FREE WIND-TUNNEL FLOWS BY ADAPTIVE-WALL TECHNOLOGY
W. R. Sears, R. J. Vidal, J. C. Erickson, Jr., and A. Ritter Jan. 1977 25 p refs Presented at the 10th Congr. of the Intern. Council of the Aeron. Sci., Ottawa, 3-8 Oct. 1976
(Contracts N00014-77-C-0052; N00014-72-C-0102)
(AD-A034889; CALSPAN-RK-6040-A-1; ICAS-Paper-76-02)
Avail: NTIS HC A02/MF A01 CSCL 14/2

The adaptive-wall or self-correcting wind tunnel has been proposed for such regimes as transonic and V/STOL where wall effects are large and cannot be corrected. The power and generality of the concept are pointed out. In a two-dimensional transonic embodiment in the Calspan One-Foot Tunnel, the scheme has been shown to work at lower transonic Mach numbers. Several practical problems are cited, including instrumentation, the nature of the wall modification, and convergence of the iterative procedure. Moreover, questions of shock-wave neutralization at the wall and probable configuration of three-dimensional embodiments are discussed. GRA

N77-24156# Army Aviation Center, Fort Rucker, Ala.
COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA) OF THE CH-47 FLIGHT SIMULATOR (CH47FS)
3 Dec. 1976 48 p refs
(AD-A033972) Avail: NTIS HC A03/MF A01 CSCL 14/2

The CH47FS CTEA Study Plan presents the purpose of the study and the terms of reference, including the problem statement, the objectives, scope, limits and assumptions, and the Essential Elements of Analysis (EEA). The alternative training packages selected for analysis and the Measures of Training Effectiveness (MOTE) are defined. The support and resource requirements for the study are listed and control procedures and the study schedule established. Included are also the methodology for analyzing training effectiveness, the operational test plan for generating effectiveness data, and the methodology for cost analysis.
Author (GRA)

N77-24157# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
VIDEO GENERATION AND CONTROL SYSTEM Final Report, Jul. 1975 - Jun. 1976
Derryl A. Williams Aug. 1976 100 p
(AF Proj. 2003)
(AD-A033853; AFAL-TR-76-164) Avail: NTIS HC A05/MF A01 CSCL 14/2

The purpose of the Video Control Center is to generate, control, monitor, and record all standard video signals needed in AFAL/AA's simulation facility. Video signals may be generated live, from video tape, or from movie film. The video signals can be monitored at the console and distributed to a remote location such as the cockpit simulator. Special effects can be used to alter the signal. Cameras are available to observe the pilot's movements during a simulation. This information, as well as all other video signals, can be recorded on tape for future reference. The system can also serve as a training tool in that demonstration and instruction tapes can be produced. For example, the operation of the DAIS computer was demonstrated and recorded using the Video Control facility. The Flying Spot Scanner is designed to simulate a raster type sensor on an aircraft. The scanner is included in this report because it is a source of video and depends on control signals from the Video Control Center for operation. This report is a description of the Video Control Center and the Flying Spot Scanner. GRA

N77-24158# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF EJECTOR-POWERED ENGINE SIMULATORS FOR WIND TUNNEL MODELS Final Report, 30 Jan. - 30 Jun. 1976
G. D. Smith, R. J. Matz, and R. C. Bauer AEDC Jan. 1977 89 p refs Sponsored by the Air Force
(ARO Proj. RF-432; ARO Proj. R32P-92A)
(AD-A034725; ARO-ETF-TR-76-81; AEDC-TR-76-128) Avail: NTIS HC A05/MF A01 CSCL 01/2

Ejector-powered engine simulators (EPES) that produce representative engine inlet and exhaust effects in wind tunnel models are currently under investigation at the Arnold Engineering Development Center (AEDC). Studies summarized in this report include theoretical and experimental investigations of single-stage, cold-flow EPES and theoretical investigations of two-stage, cold-flow EPES and of single-stage EPES driven with heated jets. Existing AEDC jet pump and ejector-diffuser analytical models were used to predict EPES exhaust-to-inlet total pressure ratio, inlet airflow, and velocity distributions during the jet mixing process. GRA

N77-24159# Springfield Municipal Airport Board, Mo.
COMPREHENSIVE PLAN AND DEVELOPMENT PROGRAM FOR A REGIONAL INDUSTRIAL AIRPARK, SPRINGFIELD MUNICIPAL AIRPORT FOR THE CITY OF SPRINGFIELD, MISSOURI
Dec. 1976 128 p Prepared in cooperation with Thompson (Arnold) and Assoc., Inc., Chicago and Isbill Assoc., Inc., Denver
(Grant EDA-05-06-01565)
(PB-262474/0; EDA-77-011) Avail: NTIS HC A07/MF A01 CSCL 05C

The planning process for the regional industrial airpark to complement the Springfield Municipal Airport development is described. Several types of land uses were evaluated in proposing a recommended plan of implementation. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-24160*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
AUXILIARY PAYLOAD POWER SYSTEM STUDY FOR SPACE PROCESSING APPLICATIONS PAYLOADS. PRELIMINARY REQUIREMENTS STUDY
Jul. 1976 84 p
(Contract NAS8-31361)
(NASA-CR-150269) Avail: NTIS HC A05/MF A01 CSCL 22A

The preliminary designs, specifications, and programmatic data for the auxiliary payload power system (APPS) are presented. The APPS concept is an independent system to be carried in the Orbiter's cargo bay having the capability of housing and supporting space processing applications (SPA) experiment payloads and augmenting Spacelab power and heat rejection capabilities as required in the performance of these experiments. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N77-24161*# Battelle Columbus Labs., Ohio.
SEASAT B ORBIT SYNTHESIS Final Report
F. G. Rea and J. M. Warmke Jul. 1976 98 p
(Contract NASw-2800)
(NASA-CR-153003; BCL-OA-TFR-76-7) Avail: NTIS HC A05/MF A01 CSCL 22A

Addition were made to Battelle's Interactive Graphics Orbit Selection (IGOS) program; IGOS was exercised via telephone lines from JPL, and candidate SEASAT orbits were analyzed by Battelle. The additions to the program enable clear understanding of the implications of a specific orbit to the diverse desires of the SEASAT user community. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-24162*# Battelle Columbus Labs., Ohio.
PLANNING FOR A DATA BASE SYSTEM TO SUPPORT SATELLITE CONCEPTUAL DESIGN Final Report
Charles R. Claydon Nov. 1976 120 p
(Contract NASw-2800)
(NASA-CR-153008; BCL-OA-TFR-76-11) Avail: NTIS HC A06/MF A01 CSCL 22A

The conceptual design of an automated satellite design data base system is presented. The satellite catalog in the system includes data for all earth orbital satellites funded to the hardware stage for launch between 1970 and 1980, and provides a concise compilation of satellite capabilities and design parameters. The cost of satellite subsystems and components will be added to the base. Data elements are listed and discussed. Sensor and science and applications opportunities catalogs will be included in the data system. Capabilities of the BASIS storage, retrieval, and analysis system are used in the system design. Author

N77-24163*# Howard Univ., Washington, D.C. School of Engineering.
THE DYNAMICS AND OPTIMAL CONTROL OF SPINNING SPACECRAFT WITH MOVABLE TELESCOPING APPENDAGES. PART C: EFFECT OF FLEXIBILITY DURING BOOM DEPLOYMENT Final Report
Peter M. Bainum and Paul K. James May 1977 50 p refs
(Grant NsG-1181)
(NASA-CR-153220) Avail: NTIS HC A03/MF A01 CSCL 22B

The dynamics of a spinning symmetrical spacecraft system during the deployment (or retraction) of flexible boom-type

appendages were investigated. The effect of flexibility during boom deployment is treated by modelling the deployable members as compound spherical pendula of varying length (according to a control law). The orientation of the flexible booms with respect to the hub, is described by a sequence of two Euler angles. The boom members contain a flexural stiffness which can be related to an assumed effective restoring linear spring constant, and structural damping which effects the entire system. Linearized equations of motion for this system, when the boom length is constant, involve periodic coefficients with the frequency of the hub spin. A bounded transformation is found which converts this system into a kinematically equivalent one involving only constant coefficients. Author

N77-24164# Weapons Research Establishment, Salisbury (Australia).
A NEW TECHNIQUE FOR OBTAINING THE AERODYNAMICS OF MISSILES FROM FLIGHT TRIALS ON A GAS GUN RANGE
R. L. Pope Nov. 1976 28 p refs
(WRE-TN-1719(WR/D)) Avail: NTIS HC A03/MF A01

A method is decribed for obtaining the low incidence, linear aerodynamic data for a missile from very simple free flight trials on a gas gun range. The images of two flashing lights, one in the nose and one in the tail of the free flight model, are recorded by three ballistic cameras. The positions of the lights are then calculated by a least squares solution of the resulting triangulation problem. The velocity of the centre of gravity and the attitude of the vehicle are estimated from the position measurements for the nose and the tail. A parameter estimation technique using the output error criterion is applied to the attitude and velocity data to obtain aerodynamic terms. The method was used successfully to estimate axial force, normal force, static stability and pitch damping moment for the test vehicle. Author

N77-24165*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
SEVERE STORMS OBSERVING SATELLITE STUDY Final Report
R. P. Iwens and D. A. Stern 30 Jun. 1976 224 p refs
(Contract NAS5-20811)
(NASA-CR-152509; TRW-26813-6003-RU-00) Avail: NTIS HC A10/MF A01 CSCL 22B

Payload distribution and the attitude control system for the multi-mission modular spacecraft/StormSat configuration are discussed. The design of the advanced atmospheric sounder and imaging radiometer (AASIR) gimbal drive and its servomechanism is described. Onboard data handling, data downlink communications, and ground data handling systems are developed. Additional topics covered include: magnetic unloading at synchronous altitude, north-south stationkeeping, and the feasibility and impact of flying the microwave atmospheric sounding radiometer (MASR) as an additional payload. A.R.H.

N77-24166# Lockheed Missiles and Space Co., Palo Alto, Calif.
RADUGA IN STATIONARY ORBIT
G. Irinin and B. Zhurin [1977] 2 p Transl. into ENGLISH from Aviats. i Kosmonav. (USSR), no. 1, 1977 p 37
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Orbit parameters of the Raduga satellite are discussed. This relay satellite assures continuous round-the-clock radiotelephone/telegraph communication in the centimeter waveband and simultaneous transmission of color and black and white Central Television programs to the network of Orbita stations. Systems on the satellite, in addition to the perfected multitrunk relay apparatus, are: triaxial accurate orientation towards earth; a power supply with independent pointing of the solar panels towards and tracking of the sun; orbit correction; thermoregulation; radio telemetry to transmit data about onboard systems operation to earth; and a radio system for exact measurement of the orbit parameters and satellite control. A.R.H.

N77-24167*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PUBLIC SERVICE COMMUNICATIONS SATELLITE USER BROCHURE
Feb. 1977 17 p ref
(NASA-TM-X-74622) Avail: NTIS HC A02/MF A01 CSCL 22A

The capabilities of a proposed communications satellite that would be devoted to experiments and demonstrations of various public services is described. A Public Service Communications Satellite study was undertaken at the NASA Goddard Space Flight Center (GSFC) to define the problems and opportunities of a renewed NASA role and the form such NASA involvement should take. The concept that has evolved has resulted from careful consideration of experiments that were already undertaken on existing satellites. Author

N77-24168# General Electric Co., Philadelphia, Pa.
VALIDATED HYBRID SIMULATION PROVIDES FLEXIBLE AVIONICS TESTING FOR MACH 20 RE-ENTRY VEHICLE
F. P. Laska 9 May 1977 28 p
(DOC-77SDR020) Avail: GE/Space and RESD Libraries, P. O. box 8555, Philadelphia, Pa. 19101 MF $10.00/HC $10.00

NOTICE: Available to NASA Offices and NASA Research Centers.

A real-time, hybrid, six-degree-of-freedom simulation was developed for use for test verification of the Navigation, Guidance, and Control Subsystem of a Maneuvering Re-entry Vehicle. The simulation employs analog and digital computers interfaced to an air-borne digital computer which provides the guidance and control functions. Additional avionics equipment can be substituted into the simulation in order to enable a full closed loop exercise of the subsystem. The simulation structure is described, the computer and hardware interfaces are explained, and the testing methodology used to verify the subsystem prior to flight is shown. Author

N77-24169*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DYNAMIC STABILITY CHARACTERISTICS OF THE COMBINATION SPACE SHUTTLE ORBITER AND FERRY VEHICLE
Delma C. Freeman, Jr. and Richmond P. Boyden Washington May 1977 115 p refs
(NASA-TM-X-3497; L-11131) Avail: NTIS HC A06/MF A01 CSCL 22B

Subsonic forced-oscillation tests of a 0.015 scale model of the space shuttle orbiter/747 ferry vehicle were conducted in the Langley high speed 7- by 10-foot tunnel at Mach numbers of 0.2, 0.4, and 0.5 for angles of attack up to 12 deg. Tests were made of the basic 747 airplane, of the modified 747 (tip fins and struts added), of the ferry configuration, (747 plus orbiter at an incidence angle of 3 deg), and of the approach and landing test configuration (747 plus orbiter at an incidence angle of 6 deg). Author

N77-24170*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
DESIGN STUDY OF TDRS ANTENNA GIMBAL SYSTEM FOR LANDSAT-D
J. Wu Apr. 1977 71 p refs
(Contract NAS5-23725)
(NASA-CR-152514; TRW-30722-6001-RU-00) Avail: NTIS HC A04/MF A01 CSCL 22B

The conceptual design studies of a two axis antenna drive assembly for the TDRSS link communications subsystem for LANDSAT D are presented. The recommended antenna drive assembly is a simple and reliable design substantially similar to the antenna and solar array drives developed and space qualified for programs such as DSCS 2 and FltSatCom. The gimbal design tradeoff is presented, along with drive electronics. Author

N77-24171*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
DESIGN STUDY FOR LANDSAT-D ATTITUDE CONTROL SYSTEM Final Technical Report
R. P. Iwens, G. E. Bernier, R. F. Hofstadter, R. A. Mayo, and H. Nakano Feb. 1977 396 p refs
(Contract NAS5-21188)
(NASA-CR-152515; TRW-14897-6010-RU-00) Avail: NTIS HC A17/MF A01 CSCL 22B

The gimballed Ku-band antenna system for communication with TDRS was studied. By means of an error analysis it was demonstrated that the antenna cannot be open loop pointed to TDRS by an onboard programmer, but that an autotrack system was required. After some tradeoffs, a two-axis, azimuth-elevation type gimbal configuration was recommended for the antenna. It is shown that gimbal lock only occurs when LANDSAT-D is over water where a temporary loss of the communication link to TDRS is of no consequence. A preliminary gimbal control system design is also presented. A digital computer program was written that computes antenna gimbal angle profiles, assesses percent antenna beam interference with the solar array, and determines whether the spacecraft is over land or water, a lighted earth or a dark earth, and whether the spacecraft is in eclipse. Author

N77-24172# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OBSERVING ARTIFICIAL SATELLITES
Laurence G. Taff 8 Oct. 1976 26 p refs
(Contract F19628-76-C-0002)
(AD-A034644; ESD-TR-76-309; ETS-4) Avail: NTIS HC A03/MF A01 CSCL 17/8

This report describes a technique that can be used to derive the penalty paid, in terms of increased apparent magnitude, for not observing artificial satellites at their maximum diffuse brightness. The procedure is applied here to the simple case of geostationary right-circular cylinders. We find that if these satellites (at their brightest) are 0.5 magnitude brighter than the system limit, then approximately. 63 percent of all such satellites within 60 deg of the GEODSS ETS will never be visible. Author (GRA)

N77-24173# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Systems Concepts Office.
FREE ROCKET SIX DEGREE OF FREEDOM DIGITAL SIMULATION
Mickie P. Stamps 8 Nov. 1976 34 p
(AD-A034920; RF-77-1) Avail: NTIS HC A03/MF A01 CSCL 19/7

This report describes in detail a free rocket six degree of freedom trajectory program which utilizes a fourth order RUNGE-KUTTA subroutine. Several options such as programmed roll, directional control, and fold out fins are described. The program includes a listing of the equations, flow charts, program description, input and output information, and a complete program listing. Author (GRA)

N77-24174# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DETERMINATION OF SPECULAR REFLECTION FROM CYLINDRICAL SATELLITES FOR ELECTRO-OPTICAL SURVEILLANCE AND SOI
Alan S. Friedman 8 Oct. 1976 33 p
(Contract F19628-76-C-0002; AF Proj. 2128)
(AD-A034580; ETS-3; ESD-TR-76-308) Avail: NTIS HC A03/MF A01 CSCL 17/8

An analysis of the timing and duration of observable specular reflections from cylindrical satellites is presented, taking into account orbital elements, attitude and axial misalignment (wobble). Results are displayed in the form of computer-generated graphic tables. Author (GRA)

N77-24175# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PERFORMANCE OF AN AIR-TO-GROUND MISSILE EMPLOYING SAR-RETRAN GUIDANCE M.S. Thesis
Edwin H. Jessup Dec. 1976 229 p refs
(AD-A034941; GAE/MC/76D-6) Avail: NTIS HC A11/MF A01 CSCL 17/9

The compatibility of a representative 500 pound weight boost-glide air-to-ground missile with the trajectory constraints imposed by a Synthetic Aperture Radar - Retransmission guidance system was investigated using a digital flight simulation. A demonstration flight profile was assumed, with a minimum of 20 seconds of tracking on the aircraft-to-target line of sight required. A guidance algorithm was developed which produced satisfactory trajectories. A first order gradient technique was employed in an unsuccessful attempt to optimize the trajectories for maximum range. A useable launch envelope for this missile was determined. The azimuthal extent of the envelope was limited by radar system constraints to 15 deg-90 deg from the aircraft velocity vector. A maximum slant range of 21 nautical miles was obtained from a launch altitude of 35,000 ft. Range deteriorated rapidly with decreasing launch altitude, with 5,000 ft being the lowest altitude at which a useable launch envelope was obtained. Maximum slant range at 5,000 ft launch altitude was 5.5 nautical miles. Author (GRA)

N77-24176# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.
SOUNDING ROCKET DELTA VELOCITY SYSTEM
Edward F. McKenna 8 Oct. 1976 14 p
(AF Proj. 7659)
(AD-A034435; AFGL-TR-76-0241; AFGL-IP-251) Avail: NTIS HC A02/MF A01 CSCL 19/7

A sounding rocket tumble system to enhance deceleration and redirect the flight path angle of a vehicle can be an effective means of accomplishing large spacial separation between a separated payload and the spent final stage rocket motor. The design and implementation of two such systems, for 9-in. - and 17-in. -diam payloads, is presented. Flight test results show that separation distances between payload and vehicle in the order of 10 percent of vehicle apogee can be achieved. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N77-24177# ARO, Inc., Arnold Air Force Station, Tenn.
SIMULATED THERMAL PROTECTION TILE ROUGHNESS EFFECTS ON WINDWARD SURFACE HEAT TRANSFER ON THE ROCKWELL INTERNATIONAL SPACE SHUTTLE ORBITER Final Report, 14 Nov. - 10 Dec. 1975
F. K. Hube AEDC Jan. 1977 63 p refs
(AD-A034733; ARO-VKF-TR-76-26; AEDC-TR-76-98) Avail: NTIS HC A04/MF A01 CSCL 22/2

Heat transfer tests on the forward half of the 0.04-scale models of the Rockwell International Space Shuttle Orbiter Configuration 140C were conducted at Mach number 8. Infrared scanning was used to determine the influence of simulated thermal protection tile roughness on windward surface heat transfer level and distribution. Tile roughness was in the form of tile surface mismatch and gaps between tiles. Tile height (measured from the smooth body wall) ranged from -0.020 in. (cavity) to 0.025 in. (protuberance), and gap width ranged from 0 to 0.020 in. Data were obtained at angles of attack of 30 to 40 deg at zero side-slip at free-stream Reynolds numbers from 2,200,000 to 15,100,000 based on the total Orbiter scaled length. The infrared system is described, and data are presented which illustrate the influence of the major test parameters. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N77-24178*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
Mu-2 RANGING
W. L. Martin and A. I. Zygielbaum 15 May 1977 81 p refs (Contract NAS7-100)
(NASA-CR-153059; JPL-TM-33-768) Avail: NTIS HC A05/MF A01 CSCL 22D

The Mu-II Dual-Channel Sequential Ranging System designed as a model for future Deep Space Network ranging equipment

is described. A list of design objectives is followed by a theoretical explanation of the digital demodulation techniques first employed in this machine. Hardware and software implementation are discussed, together with the details relating to the construction of the device. Two appendixes are included relating to the programming and operation of this equipment to yield the maximum scientific data. Author

N77-24179*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE VIKING 1975 MISSION TO MARS. VOLUME 2: LAUNCH THROUGH LANDING OF VIKING 1
D. J. Mudgway and M. R. Traxler 15 Mar. 1977 260 p refs (Contract NAS7-100)
(NASA-CR-153062; JPL-TM-33-783-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 22D

Problems inherent in the deployment and management of a worldwide tracking and data acquisition network to support the two Viking Orbiters and two Viking Landers simultaneously over 320 million kilometers (200 million miles) of deep space are discussed. Activities described include tracking coverage of the launch phase, the deep space operations during the long cruise phase that occupied approximately 11 months, and the implementation of the a vast worldwide network of tracking sttions and global communications systems. The performance of the personnel, hardware, and software involved in this vast undertaking are evaluated. Author

N77-24180# Wyoming Univ., Laramie. Dept. of Mechanical Engineering.
A LASER SYSTEM FOR DETERMINATION OF ROCKET ATTITUDE USING TWO GROUND STATIONS Final Report, 10 Nov. 1975 - 9 Nov. 1976
John E. Nydahl and Kynric M. Pell Dec. 1976 89 p refs (Contract DAAG29-76-G-0073)
(AD-A034785; UWME-DR-6051101; ARO-13640.1-A-E) Avail: NTIS HC A05/MF A01 CSCL 17/9

A system that can measure the attitude of a spinning rocket when coupled with a laser radar tracker was investigated. The attitude sensing system consists of at least two ground based laser transmitter/detector stations which illuminate the rocket with continuous wave lasers as it moves downrange. Pulses that are reflected from two roof type prisms onboard the spinning vehicle back to the two transmitting stations along with position data obtained from the tracking laser radar form the basis for determining the missile's pitch and yaw. A static bench scale demonstration, a dynamic computer simulation and sensitivity analysis of this concept all continue to support this system as a viable alternative to the current photographic technique for determining missile attitude. Author (GRA)

N77-24181# Science Applications, Inc., Huntsville, Ala.
COMPARISON OF THE PERIMETER ACQUISITION RADAR (PAR) SATELLITE TRACK CAPABILITY TO THE SPACE DEFENSE CENTER (SDC) SATELLITE CATALOGUE: UNKNOWN SATELLITE TRACK EXPERIMENT, VOLUME 1
J. K. Hendren and A. Anderson 13 Oct. 1976 54 p refs (Contract DASG60-76-C-0011)
(AD-A034014; SAI-77-701-HU-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17/9

This experiment was performed by SAI under direction of BMDSC-W at the request of ADCOM. The purpose of the experiment is to determine the PAR's capability to detect and track objects that are not in the Space Defense Center (SDC) satellite catalogue, to determine the PAR's capability to reduce the potential for space tragedy for NASA's manned missions by supplementing the catalogue, and to determine some of the characteristics of the objects seen by the PAR that are not in the catalogue. The report is divided into two volumes. In Volume I is an overview of the analysis methods, and the bulk of the results, and recommendations and conclusions. In Volume 2 are the details of the analysis methods, and a set of plots showing the Radar Cross Section (RCS) distributions for PAR tracks for both those that correlated with the catalogue and those that did not for various altitude bands. Author (GRA)

N77-24182# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
HIGH ACCURACY AIRCRAFT TO SATELLITE TRACKING: AN EVALUATION OF TWO PROPOSED FILTER MODELS M.S. Thesis
Robert E. Mann, Jr. Dec. 1976 144 p refs
(AD-A034272; GE/EE/76-33) Avail: NTIS HC A07/MF A01 CSCL 17/9

This study treats the high accuracy tracking of a satellite from an aircraft. The purpose is to evaluate the feasibility of several reduced order system models for implementation in an extended Kalman filter formulation whose estimates would be used to aid the tracker. The first filter model is a twelve state model in which filter estimates of the satellite inertial position and velocity are obtained and used in the estimation of the tracker states. A second, six state-model deletes these six satellite states, and tracker state estimation is accomplished by exploiting the information already available in the tracking geometry, dominant modes of satellite dynamics, and the range measurement. Tracker state estimation is accomplished in the line of sight coordinate frame for both filter formulations. A covariance analysis was performed, evaluating each filter against a 42 state truth model. The tracking profile used in the study was specifically designed to evaluate each filter's state estimation capability when faced with a highly nonlinear tracker angular rate history. It was concluded that the six state filter is a viable alternative, and, with some proposed modifications, is preferable (because of its simplicity and lower computational burden) and warrants further study. Author (GRA)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-24183*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL PERFORMANCE OF AN INTEGRATED THERMAL PROTECTION SYSTEM FOR LONG-TERM STORAGE OF CRYOGENIC PROPELLANTS IN SPACE
Richard L. DeWitt and Robert J. Boyle Washington May 1977 109 p refs
(NASA-TN-D-8320; E8881) Avail: NTIS HC A06/MF A01 CSCL 22B

It was demonstrated that cryogenic propellants can be stored unvented in space long enough to accomplish a Saturn orbiter mission after 1,200-day coast. The thermal design of a hydrogen-fluorine rocket stage was carried out, and the hydrogen tank, its support structure, and thermal protection system were tested in a vacuum chamber. Heat transfer rates of approximately 23 W were measured in tests to simulate the near-Earth portion of the mission. Tests to simulate the majority of the time the vehicle would be in deep space and sun-oriented resulted in a heat transfer rate of 0.11 W. Author

N77-24184# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Aeroballistics Directorate.
A STUDY OF VARIOUS SLENDER AND NON-SLENDER FIN-BODY COMBINATIONS OF MISSILE CONFIGURATIONS
N. Uchiyama and J. M. Wu 12 Nov. 1976 189 p refs
(AD-A034201; RD-CR-76-5) Avail: NTIS HC A09/MF A01 CSCL 19/7

The aerodynamic loading on a number of rocket body-control surface combinations has been calculated using methods developed at the University of Tennessee Space Institute over the past five years. Variations in control surface planform, roll angle, control surface deflection or incorporation of elevons, are included. Compressibility is accounted for. Details of the digital computer program are included. GRA

N77-24185# Massachusetts Inst. of Tech., Cambridge.
ABSTRACTS
Aug. 1976 127 p refs Presented at the 1976 AFOSR Contractors Meeting on Air-Breathing Combust. Dyn., Wright-Patterson, AFB, Ohio, 11-13 Aug. 1976
(Grant AF-AFOSR-2619-74)
(AD-A033035; AFOSR-76-0815TR) Avail: NTIS HC A07/MF A01 CSCL 19/7

The report consists of a collection of abstracts of the numerous research progress reports given by AFOSR contractors and of invited papers from other governmental agencies and contractors. These papers presented over a three-day period composed the 1976 annual contractors meeting on air-breathing combustion dynamics. The principal investigators and their organizational association are also identified. Author (GRA)

N77-24186# Naval Academy, Annapolis, Md.
THE DESIGN, CONSTRUCTION AND FLIGHT TESTING OF A LARGE LIQUID PROPELLANT MISSILE
David E. Crisalli 3 Jun. 1976 67 p refs
(AD-A032714; USNA-TSPR-76) Avail: NTIS HC A04/MF A01 CSCL 19/7

The paper describes the design, construction, and testing of a liquid fueled rocket. Design calculations for the engine and propulsion systems were performed, checked, and an engine was constructed to those specifications. A static test stand was constructed and instrumented to evaluate engine performance during full duration static firings. The engine and propulsion system proved successful and were then incorporated into the flight vehicle. The remainder of the paper describes the design, construction, and testing of all flight hardware including an on-board camera system and recovery system. Two unsuccessful attempts to launch the missile were made on 11 May 1976 at White Sands Missile Range in New Mexico. The reasons for the failure were corrected and the missile was succesfully launched on 17 May 1976. Author (GRA)

N77-24187# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A FUEL CONSERVATION NEAR-OPTIMAL CONTROL LAW FOR AN EVADING SPACECRAFT M.S. Thesis
William V. Green Dec. 1976 81 p refs
(AD-A034945; GA/MC/76D-8) Avail: NTIS HC A05/MF A01 CSCL 22/2

A fuel conservation control law for an evading spacecraft is tested in a free final time, pursuit-evasion differential game. A form of differential dynamic programming with periodic updating is used to solve the optimal control problem. The control law is tested against two different finds of pursuers. One of the pursuers is using the same updating of the optimal control scheme and the other pursuer is using a non-optimal control law. The non-optimal control law produces a collision course between the two craft. The evader is able to take advantage of any non-optimal play by the pursuer. The evader is able to optimize the combination of final range and final mass, depending on the mission. Plots comparing the flight path of the evader and several different pursuers are included. Author (GRA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-24188*# Rocketdyne, Canoga Park, Calif.
LASER-HEATED ROCKET THRUSTER Final Report, Jun. 1975 - Jun. 1976
J. M. Shoji 12 Apr. 1977 187 p refs
(Contract NAS3-19728)
(NASA-CR-135128; R76-104) Avail: NTIS HC A09/MF A01 CSCL 21H

A space vehicle application using 5,000-kw input laser power was conceptually evaluated. A detailed design evaluation of a 10-kw experimental thruster including plasma size, chamber size, cooling, and performance analyses, was performed for 50 psia chamber pressure and using hydrogen as a propellant. The 10-kw hardware fabricated included a water cooled chamber, an uncooled copper chamber, an injector, igniters, and a thrust stand. A 10-kw optical train was designed. Author

N77-24189*# Aerotherm Corp., Mountain View, Calif.
BOUNDARY LAYER INTEGRAL MATRIX PROCEDURE: VERIFICATION OF MODELS Final Report
William S. Bonnett and R. Michael Evans Apr. 1977 74 p refs
(Contract NAS8-31961; Aerotherm Proj. 7239)
(NASA-CR-150271; AEROTHERM-77-239) Avail: NTIS HC A04/MF A01 CSCL 21H

The three turbulent models currently available in the JANNAF version of the Aerotherm Boundary Layer Integral Matrix Procedure (BLIMP-J) code were studied. The BLIMP-J program is the standard prediction method for boundary layer effects in liquid rocket engine thrust chambers. Experimental data from flow fields with large edge-to-wall temperature ratios are compared to the predictions of the three turbulence models contained in BLIMP-J. In addition, test conditions necessary to generate additional data on a flat plate or in a nozzle are given. It is concluded that the Cebeci-Smith turbulence model be the recommended model for the prediction of boundary layer effects in liquid rocket engines. In addition, the effects of homogeneous chemical reaction kinetics were examined for a hydrogen/oxygen system. Results show that for most flows, kinetics are probably only significant for stoichiometric mixture ratios. Author

N77-24190*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE 6670-NEWTON ATTITUDE-CONTROL THRUSTER USING HYDROGEN-OXYGEN PROPELLANT
Larry H. Gordon Washington May 1977 39 p refs
(NASA-TM-X-3523; E-8981) Avail: NTIS HC A03/MF A01 CSCL 21H

The development of a reusable, attitude-control propulsion system for the space transportation system is discussed. A flight weight, gaseous oxygen attitude control thruster assembly was tested to obtain data on cyclic life, thermal and hydraulic characteristics, pulse response, and performance. The basic thruster components were tested in excess of 51,000 pulses and 660 seconds, steady state, with no degradation of the 93 percent characteristic exhaust velocity efficiency level. Nominal operating conditions were a chamber pressure of 207 N sq cm (300 psia), a mixture ratio of 4.0, a pulse width of 100 ms, and a pulse frequency of 2 Hz. Author

N77-24191*# National Aeronautics and Space Administration, Washington, D. C.
LIQUID ROCKET DISCONNECTS, COUPLINGS, FITTINGS, FIXED JOINTS, AND SEALS NASA Space Vehicle Design Criteria (Chemical Propulsion)
Sep. 1976 164 p refs
(NASA-SP-8119) Avail: NTIS HC A08/MF A01 CSCL 21H

State of the art and design criteria for components used in liquid propellant rocket propulsion systems to contain and control

the flow of fluids involved are discussed. Particular emphasis is placed on the design of components used in the engine systems of boosters and upper stages, and in spacecraft propulsion systems because of the high pressure and high vibration levels to which these components are exposed. A table for conversion of U.S. customary units to SI units is included with a glossary, and a list of NASA space vehicle design criteria monographs issued to September 1976. A.R.H.

N77-24192# Purdue Univ., Lafayette, Ind. SQUID Headquarters.
APPLICABILITY OF LASER RAMAN SCATTERING DIAGNOSTIC TECHNIQUES TO PRACTICAL COMBUSTION SYSTEMS Technical Report, 28 Jan. - 31 Aug. 1976
Alan C. Eckbreth Oct. 1976 96 p refs Prepared by United Technol. Res. Center
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A032492; SQUID-TR-UTRC-4-PU; UTRC-R76-952296-2) Avail: NTIS HC A05/MF A01 CSCL 20/6

Laser Raman scattering techniques for combustion diagnosis have undergone considerable development in the past several years and are now being employed in a number of fundamental flame investigations. However, from an instrumentation viewpoint, practical combustion environments can differ greatly from the flames typically employed in fundamental studies. In particular, pulsed laser Raman thermometry experiments have shown laser modulated particulate (soot) incandescence to be an especially severe problem. Particles in the measurement volume, which, at flame temperatures, are already incandescent and contribute significantly to the total luminous emission, absorb the incident Raman inducing laser radiation, heat to temperatures far above ambient, and emit greatly increased amounts of gray/blackbody radiation which can exceed the sought-for Raman signal levels by several orders of magnitude. Under Project SQUID sponsorship, a detailed study of this phenomenon has been conducted, the results of which are reported herein. GRA

N77-24193# Aerodyne Research, Inc., Bedford, Mass.
GROWTH OF CARBON PARTICLES IN ROCKET EXHAUST Final Scientific Report, 1 Sep. 1973 - 30 Sep. 1976
David M. Mann Nov. 1976 37 p refs
(Contract F44620-74-C-0005)
(AD-A033892; ARI-RR-92; AFOSR-76-1423TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

The specific approach taken in this work was to study particle formation in a cooling jet of carbon vapor diluted by an inert carrier gas. Vapor was produced by the evaporation of a resistance heated graphite tube. The carbon vapor, mixed with carrier gas, flowed into a light scattering chamber where spectroscopic measurements were used to monitor concentrations of molecular species. Particles were also collected for electron microscopy. An initial reaction leading to particle formation was identified as C2-C3 yields C5 with a gas kinetic rate. Particulates were found to be spherical, of approximately equal diameter and frequently chained in the manner of hydrocarbon soot. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N77-24194*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EQUATION THAT DESCRIBES MATERIAL OUTGASSING FOR CONTAMINATION MODELING
Thomas M. Heslin Washington May 1977 17 p refs
(NASA-TN-D-8471; G7702F5) Avail: NTIS HC A02/MF A01 CSCL 07D

A generalization of the Clausius-Claperon equation for vapor pressure is made for an outgassing material. The expression is derived using Langmuir's equation for the outgassing rate of a material and using an empirical equation for the vapor pressure of a material as a function of its molecular weight and temperature. Also, outgassing rate equations are derived in terms of the vapor pressure of the outgassing material for three general geometries. Author

N77-24195# Northwestern Univ., Evanston, Ill. Materials Research Center.
BASIC AND APPLIED RESEARCH IN MATERIALS Annual Technical Report, 1 Jun. 1975 - 30 Jun. 1976
J. Wagner 30 Jun. 1976 18 p refs
(Contract N00014-75-C1116; ARPA Order 3017)
(AD-A034074) Avail: NTIS HC A02/MF A01 CSCL 10/3

This report describes the research carried out in two major areas: (1) materials for energy storage and (2) heterogeneous catalysis, materials for energy storage. The discovery of new types of solid electrolytes (such as beta alumina, RbAg4I5, copper and silver halides and stabilized zirconia) with large values of ionic conductivity at relatively low temperatures has enhanced the prospect of developing battery systems possessing a high energy storage-to-weight ratio, high power output capability, long life in service, efficiency in charge-discharge characteristics and the capability of being constructed from inexpensive, readily obtainable materials. Heterogeneous catalysis: a number of the most important heterogeneous catalysts consist of tiny crystallites of metal supported upon a carrier such as silica or alumina. The support leads to a greater metallic surface area per gram of metal and permits use of the catalyst at temperatures up to 500 C without rapid sintering. However, relatively little is known of the exact nature of the crystallites (including the nature of their attachment to the support), the effect of the support upon the catalyst behavior, the effect of the method of catalyst preparation upon catalytic activity. It is the purpose of this project to provide some resolution of these problems. Author (GRA)

N77-24196# Materials Research Labs., Maribyrnong (Australia).
PROCEEDINGS OF THE 2D ORGANIC COATINGS SYMPOSIUM
J. T. Hinde Sep. 1976 69 p refs Symp. held at Maribyrnong, Australia, 6 Aug. 1975
(AD-A034407; MRL-R-671) Avail: NTIS HC A04/MF A01 CSCL 11/3

The Proceedings of the Second Organic Coatings Symposium at Materials Research Laboratories provides details of the nine lectures delivered. In addition to recent technical developments in paints the lecture covers such aspects as the formation of phosphate and chromate conversion coatings, assessment of camouflage systems, factors affecting paint deterioration, and the prevention of fungal growth on paints. In addition the problem areas of particular interest to the Services are discussed.
Author (GRA)

N77-24197# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
SYNTHESIS OF ORGANOFLUORINE COMPOUNDS BY DIRECT FLUORINATION Final Report, 1 Mar. 1974 - 30 Jun. 1976
Richard J. Lagow 1976 10 p
(Grant AF-AFOSR-2691-74; AF Proj. 9538)
(AD-A033833; AFOSR-76-1305TR) Avail: NTIS HC A02/MF A01 CSCL 07/2

The objective of this research is to utilize a new fluorination technique for making fluorocarbon oligomers and polymers. The work will provide methods for synthesizing monomers and oligomers useful in making fluorocarbon ether elastomers. The research is aimed at the utilization of a direct fluorination technique for the conversion of organic compounds, particularly oxygen-containing organic compounds to polymerizable difunctional perfluorinated monomers and oligomers. Author (GRA)

N77-24198# Boston Univ., Mass. Dept. of Chemistry.
PHOTOISOMERIZATION OF LINKED ANTHRACENSES. A DEMANDING TEST OF MOLECULAR GEOMETRY FOR INTERMEDIATES IN PHOTODIMERIZATION Technical Report, 1 Nov. 1975 - 31 Aug. 1976
William R. Bergmark and Guilford Jones, II 1 Dec. 1976 11 p refs Submitted for publication Sponsored in part by NSF
(Contract N00014-76-C-0442; NR Proj. 051-574)
(AD-A034176; TR-5) Avail: NTIS HC A02/MF A01 CSCL 07/3

Valence photoisomerization and photophysical properties of

a series of dianthry-lethanes, dianthrylmethanes, and tetrabenzo(2.2)paracyclophane are reported. Fluorescence lifetimes and quantum yields depend upon the nature of the linkage between anthracene moieties. Quantum efficiency for photoisomerization depends on the substitution pattern at 10,10 prime positions. Sandwich dimers with excimer-like interaction are generated on low temperature photolysis in glasses of dianthrylethane but not dianthrylmethane. It is concluded that geometrical requirements for excimerization and photodimerization are quite different.
Author (GRA)

24 COMPOSITE MATERIALS

Includes laminates.

N77-24199*# Lockheed-California Co., Burbank.
FLIGHT SERVICE EVALUATION OF KEVLAR-49/EPOXY COMPOSITE PANELS IN WIDE-BODIED COMMERCIAL TRANSPORT AIRCRAFT Annual Report
R. H. Stone Mar. 1977 42 p refs
(Contract NAS1-11621)
(NASA-CR-145141; AR-3) Avail: NTIS HC A03/MF A01 CSCL 11D

Kevlar-49 fairing panels, installed as flight service components on three L-1011s, were inspected after three years' service, and found to be performing satisfactorily. There are six Kevlar-49 panels on each aircraft, including sandwich and solid laminate wing-body panels, and 150 C service aft engine fairings. The service history to date indicates that Kevlar-49 epoxy composite materials have satisfactory service characteristics for use in aircraft secondary structure.
Author

N77-24200*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ABRASION RESISTANT COATINGS FOR PLASTIC SURFACES Patent Application
John R. Hollahan (Tegal Corp., Richmond, Calif.) and Theodore Wydeven, Jr., inventors (to NASA) Filed 16 May 1977 13 p
(NASA-Case-ARC-10915-3; US-Patent-Appl-SN-797217) Avail: NTIS HC A02/MF A01 CSCL 11D

Abrasion resistant protective coatings for plastic surfaces such as acrylics, polystyrenes, and polycarbonates are provided by the plasma polymerization of at least one member of a group of organosilane compounds. The group consists of vinyltrichlorosilane, tetraethoxysilane, vinyltriethoxysilane, tetravinylsilane, vinyltriacetoxysilane, hexamethyldisilazane, tetramethylsilane, vinyldimethylethoxysilane, vinyltrimethoxysilene and methyltrimethoxysilane. Plasma polymerization of these organosilane compounds provides an abrasion resistant protective coating for plastic optical surfaces together with a uniform optically clear layer in the 4,000 to 8,000 angstrom range.
NASA

N77-24201# Westinghouse Research Labs., Pittsburgh, Pa.
PROGRESS TOWARD A PRACTICAL Nb-Ge CONDUCTOR
A. I. Braginski, J. R. Cavaler, G. W. Roland, M. R. Daniel, M. A. Janocko, and A. T. Santhanam 1976 7 p refs Presented at Appl. Superconductivity Conf., Stanford, Calif., 17 Aug. 1976
(Contract EY-76-C-02-2522)
(COO-2522-6; Conf-760829-45) Avail: NTIS HC A02/MF A01

Properties of high-T/sub c/Nb-Ge films deposited by sputtering and by chemical vapor deposition (CVD) were investigated. Results of sputtering in the presence of controlled levels of O2, N2, Si, and of reactive sputtering in Ar-GeH4, suggest that the high-T/sub c/A15 phase is impurity- or defect-stabilized. In CVD deposits two tetragonal modifications were found: sigma and T2, the latter probably stabilized by Cl2. High critical current densities, J/sub c/ (H, T) of fine-grained sputtered films are attributed to flux pinning on A15 grain boundaries. Comparably high J/sub c/'s were also obtained in CVD A15 films doped with impurities. Low field ac losses p (H, T) were correlated with J/sub c/ and coating geometries. The feasibility of fabricating multifilamentary composite conductors by CVD was demonstrated experimentally.
ERA

N77-24202# Army Construction Engineering Research Lab., Champaign, Ill.
EVALUATION OF LOAD-BEARING HONEYCOMB CORE SANDWICH PANELS Final Report
Edward J. Worrell and Bruce H. Wendler Nov. 1976 59 p refs
(DA Proj. 4A7-62619-AT-41)
(AD-A033755; CERL-TR-D-75) Avail: NTIS HC A04/MF A01 CSCL 13/3

The report describes an investigation of the performance of three-ply and five-ply paper honeycomb core sandwich panels. The core of the three-ply material consisted of metallic skins bonded to a cellular paper ply; the five-ply construction had 1/8-in.(3.2 mm) hardboard or asbestos board bonded to the metal skin which was bonded to the honeycomb paper. The panels were tested for fire safety, superficial damage, thermal conductivity, and durability. It was found that addition of backup plies did not significantly affect performance in thermal conductivity, durability, or large import loads; however, a significant increase in performance was achieved in localized superficial damage and five endurance times. The improved fire performance of the five-ply panels was still decidedly inferior to that of conventional wood stud construction. Further study should be made to determine if simple changes in the basic design of the panel are available which could bring the fire performance up to the level of conventional construction.
GRA

N77-24203# Rockwell International Science Center, Thousand Oaks, Calif.
IMPACT DAMAGE IN CARBON/CARBON COMPOSITES Technical Report, 1 May - 31 Dec. 1976
A. G. Evans, W. F. Adler, and J. C. Chesnutt 31 Dec. 1976 88 p refs
(Contract N00014-76-C-0854)
(AD-A034487; SC5076.2TR) Avail: NTIS HC A05/MF A01 CSCL 11/4

The damage to carbon-carbon composites created by projectile impacts has been characterized for a range of test conditions and for several weave constructions and processing variables. A number of subsurface damage modes have been identified (on sectioned specimens) in the vincinity of the crater produced by particulate impingement. In addition, studies are underway to determine the modes of failure which occurred in the material ejected from the crater. Preliminary analyses of the primary subsurface damage modes have been undertaken to define the approach that would elucidate the microstructural dependence of the impact damage.
Author (GRA)

N77-24204# Naval Air Development Center, Warminster, Pa. Dept. of Air Vehicle Technology.
RESEARCH ON METAL MATRIX COMPOSITES FOR NAVAL AIRCRAFT ENGINES Progress Report, 1 Nov. 1971 - 31 Oct. 1975
Marshall K. Thomas 25 Aug. 1976 65 p refs
(WR02204001)
(AD-A033724; NADC-76217-30; PR-2) Avail: NTIS HC A04/MF A01 CSCL 21/5

Directionally solidified ingots of binary titanium base eutectics with iron, cobalt, and nickel have been analyzed metallographically and tested in tension. Of these alloys, the one having a titanium matrix with 40 percent volume fraction TiFe fibers appears to have the most promising morphology. Metallographic studies of arc melted buttons of columbium base binary, ternary, and quaternary alloys indicate several eutectic alloy systems with a potential for structural applications. A study of a Cr-25Cb-34Al (wt. percent) directionally solidified alloy has verified the presence of a eutectic at the composition predicted by the computer model of Kaufman and Nesor. Preliminary weight gain oxidation tests at 2200 F indicate the Cr-25Cb-34Al eutectic in the directionally solidifed condition is superior in oxidation resistance to the carbide reinforced and directionally solidified eutectics currently being developed.
GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N77-24205 British Library Lending Div., Boston Spa (England).
METHOD AND EQUIPMENT FOR THE INTRODUCTION OF LIQUID WASTE FUELS INTO A FLUIDIZED LAYER
Pavel Novotny and Karel Hanyk Nov. 1976 6 p Transl. into ENGLISH from Czech patent no. 158913 (1975)
(BLL-RTS-10400) Avail: British Library Lending Div., Boston Spa, Engl.: £3.00; 3 BLL overseas, 3 European or 12 UK BLL photocopy coupons

A method and equipment for feeding liquid waste fuels into a fluidized layer while changing the composition of the fuel being introduced is described. The problem of self-supported combustion of different kinds of liquid flammable wastes with a minimum requirement for fitting out the equipment and with simple operation is solved. The combustion of the waste fuel takes place in a two-stage fluid burner with a relative shortage of air in such a way that the surplus of air in the fluid reactor is always less than unity, and the combustible gas leaving the fluid reactor is not burned until the second focus of combustion. Author

N77-24206 British Library Lending Div., Boston Spa (England).
INVESTIGATING THE QUALITATIVE LIBERATION OF HYDROGEN CHLORIDE IN THE CASE OF THE DECOMPOSITION OF CHLOROPRENE NATURAL RUBBER AND BURNING RUBBER BASED ON THE LATTER
P. P. Shchegiov 20 Dec. 1976 7 p refs Transl. into ENGLISH from Proiz. Sheen Rezinotekhnicheskikh Asbestotekhnicheskikh Izoelii (USSR), no. 7, 1975 p 34-35
(BLL-CE-Trans-7030-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

KRB type natural rubber and Nairit based rubber were subjected to thermal and thermo-oxidizing decomposition and combustion. Thermal decomposition was carried out in an argon medium using the thermal shock method, the material undergoing testing being placed in a reaction vessel pre-heated to a specific temperature (200-800 C). In the case of thermo-oxidizing decomposition the natural rubber was heated at a rate of 30 C/min. in a stream of air, the flow rate of which amounted to 500 ml./min. The material was heated to 900 C. The synthetic rubber was burned in a stream of air fed at a rate of 3 litres/min. at an ambient temperature of 860 C. The quantitative hydrogen chloride content in the decomposition and combustion products was 30 percent of the sample, or 85 percent of the entire chlorine contained in the natural rubber. The temperature at which hydrogen chloride liberation commences lies in the range of 220-230 C, while the main mass of hydrogen chloride is liberated at 370-380 C. No liquid breakdown products were observed. Author

N77-24207*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF A SLICING DEVICE FOR APOLLO-SOYUZ TEST PROJECT (ASTP) ELECTROPHORESIS TECHNOLOGY EXPERIMENT MA-011
B. H. Nerren Apr. 1977 18 p
(NASA-TM-X-73395) Avail: NTIS HC A02/MF A01 CSCL 07D

The electrophoresis of six columns was accomplished on the Apollo-Soyuz test Project. After separation, these columns were frozen in orbit and were returned for ground-based analyses. One major goal of the MA-011 experiment was the assessment of the separation achieved in orbit by slicing these frozen columns. The slicing of the frozen columns required a new device. The development of that device is described. Author

N77-24208*# Kanner (Leo) Associates, Redwood City, Calif.
ACTIVATION OF GAMMA-FeOOH WITH AMPHOTERIC HYDROXIDES AND ANOMALOUS BEHAVIOR OF CERTAIN COMPLEX CATALYSTS OF THIS TYPE
Alfonse Krause and Jerzy Wisniewski Washington NASA Apr. 1977 13 p refs Transl. into ENGLISH from Roczniki Chemii (Poland), v. 27, 1953, p 232-241
(Contract NASw-2790)
(NASA-TT-F-17421) Avail: NTIS HC A02/MF A01 CSCL 07D

Hydrides of copper, magnesium, aluminum, and lead were precipitated using an ammonia or NaOH solution on moist gamma-FeOOH hydrogel mixed in an aqueous salt of metal solution of the activator. After they were washed with distilled water and air dried, the mixed hydroxides were used as catalysts in the oxidation reaction of formic acid with hydrogen peroxide at temperatures ranging from 20 to 50 C. The activity of the activators was measured at 20, 37, and 50 C. Data are presented in tabular form. Author

N77-24209*# Kanner (Leo) Associates, Redwood City, Calif.
CATALYTIC ACTIVITY OF SOME HETEROGENEOUS CATALYSTS AND THEIR SURFACE AREA
Alfonse Krause and Alexsandra Binkowna Washington NASA Apr. 1977 14 p refs Transl. into ENGLISH from Roczniki Chemii (Poland), v. 31, 1957 p 801-808
(Contract NASw-2790)
(NASA-TT-F-17422) Avail: NTIS HC A02/MF A01 CSCL 07D

The adsorption, surface area and catalytic activity of various ferric hydroxides in reducing/oxidating systems were investigated. Quantitative data obtained indicates that amorphous ferric orthohydroxide occupies the first place with respect to catalytic activity. Crystalline ferric hydroxides are markedly inferior in oxidation reactions and H2O2 breakdown, although they have the largest surface among the ferric hydrates investigated. Author

N77-24210*# Scientific Translation Service, Santa Barbara, Calif.
CATALYTIC ACTION OF VARIOUS TYPES OF FERRIC HYDRATE IN THE PRESENCE OF ACTIVATORS
Ofelia Belfiori Washington NASA Apr. 1977 13 p refs Transl. into ENGLISH from Gazz. Chim. Italizna (Italy), v. 68, 1938 p 405-411
(Contract NASw-2791)
(NASA-TT-F-17423) Avail: NTIS HC A02/MF A01 CSCL 07D

The action of activators in the oxidation of H.COOH by H2O2 promoted by ferric hydrate is studied. Small amounts of copper exhibit a strong action; Mn, Ni, Co, Zn do not act in the same way. Author

N77-24211# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE THEORY OF COMBUSTION PROCESSES IN HETEROGENEOUS CONDENSED MEDIA
B. I. Khaikin 1976 23 p refs Transl. into ENGLISH from Protsessy Goreniia v Khimicheskoi Tekhnologii i Metallurgii (USSR), 1975 p 227-244
Avail: NTIS HC A03/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The combustion mechanism of mixed powders, heterogeneous systems in whose combustion zone gasification of the substance occurs because of chemical reactions or phase transitions, was studied. Specific topics discussed include: (1) combustion of an ordered laminar system; (2) deductions for real heterogeneous systems; (3) stationary propagation of the combustion zone; (4) melting components and reaction products; and (5) stability of the stationary combustion mode, self-oscillating combustion, and combustion limits. A theoretical analysis is presented.J.M.S.

N77-24212# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF RADIATION ON THE PRESSURE DEPENDENCE OF THE UPPER LIMIT OF LUMINOUS FLAME PROPAGATION
E. A. Granovskii, V. N. Gudkovich, and B. G. Piskunov 26 Dec. 1974 6 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), v. 13, no. 1, 1977 p 67-71
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The pressure dependence of radiation heat loss in sooty flames was investigate using a vertical tube connected at the upper end to a nitrogen filled tank. Propylene-oxygen mixtures

were prepared under high pressure and agitated electromagnetically. The composition obtained was checked by selecting samples from the mixer and the tube and a subsequent analysis with a + or -0.1% accuracy on a VTI-2. The mixture was ignited by a hot wire at the upper end of the tube which was open during flame propagation. An analytic expression is obtained for the limit pressure of flame propagation in a mixture of definite composition. Author

N77-24213# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE MECHANISM OF ELECTRODE REACTIONS OF HYDROGEN PEROXIDE ON CARBON MATERIALS IN NEUTRAL ELECTROLYTES
A. I. Anurova, E. V. Bairachnyi, and T. I. Barkova 1977 5 p refs Transl. into ENGLISH from Elektrokhimiya (USSR), v. 13, no. 1, 1977 p 54-58
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The mechanism of electrode reactions of hydrogen peroxide on carbon and pyrographite electrodes in aqueous solutions of sodium sulfate is investigated. The fundamental parameters of the electrochemical kinetics of the electroreduction and electrooxidation reactions of hydrogen peroxide are determined, and representations are expressed about the stage mechanism of these reactions with retarded stages of the transition of the first electron. Author

N77-24214# California Univ., Livermore. Lawrence Livermore Lab.
EBF1: A COMPUTER SIMULATION OF THE PREBURST BEHAVIOR OF ELECTRICALLY HEATED EXPLODING FOILS
J. D. Logan (Kansas State Univ.) and R. S. Lee (Kansas State Univ.) Jun. 1976 31 p refs
(Contract W-7405-eng-48)
(UCRL-52003) Avail: NTIS HC A03/MF A01

A computer code is presented for calculating the transient temperature and current distributions in electrically exploded foils. The model is applicable up until the time of burst. Calculations presented for aluminum, copper, and gold foils show good agreement with experimental current waveforms and burst times over a wide range of capacitor bank charging voltages and for varying foil cross sections. The two dimensional nature of the calculation permits investigation of effects associated with nonuniform heating of the foil and gives an estimate of the simultaneity of burst. ERA

N77-24215# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A SPARK INSENSITIVE ACTUATOR/IGNITER
Edwin A. Kjeldgaard Sep. 1976 27 p refs Presented at the 5th Intern. Pyrotechnic Seminar, 12-16 Jul. 1976
(Contract E(29-1)-789)
(SAND-76-0508) Avail: NTIS HC A03/MF A01

The development of a new, spark insensitive pyrotechnic material, TiH/sub x//KClO4, for actuators and igniters is discussed. The parametric investigation of the material is primarily aimed at answering the question: can a pyrotechnic be sensitive to hot wire ignition, yet insensitive to ignition from a spark generated by a human body? A number of variables were studied, among which are the following: hydrogen and oxygen content, surface area and particle size, powder density at the bridgewire, component hardware configuration, ignition energy, and calorific output. The results of the investigation answered the question posed above in the affirmative. Spark sensitivity was found to be a function of hydrogen content and surface area, while bridgewire ignition sensitivity and reliability were primarily determined by the powder density at the bridgewire. ERA

N77-24216# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
LASER FLUORESCENCE SPECTROSCOPIC INVESTIGATIONS OF THE (A 1 SIGMA(+)=X 1 SIGMA(+)) SYSTEM OF 7LiD Ph.D. Thesis - Goettingen Univ., West Ger. [LASERFLUORESZENZSPEKTROSKOPISCHE UNTERSUCHUNGEN AN DEM (A 1 SIGMA(+) - X 1 SIGMA(+))-SYTEM VON 7LiD]
Guenther Ennen Sep. 1976 133 p refs In GERMAN
(MPIS-15/1976) Avail: NTIS HC A07/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 22.50

The laser fluorescence spectroscopy method was used to investigate the 7LiD molecule. The wavelengths and intensities of the fluorescence series were measured. New molecular constants for the X-state were determined from the wavelengths, and improved constants for the A-state were obtained from available data and a fit. Several methods for determining potential curves from molecular constants are discussed and applied to the new constants. The fluorescence line intensities were used to determine the transition probabilities. ESA

N77-24217# European Space Agency, Paris (France).
COHERENT ANTI-STOKES RAMAN SCATTERING NEAR ELECTRONIC RESONANCES AND FABRICATION OF AN EXPERIMENTAL SET-UP
Sylvie Druet Apr. 1977 120 p refs Transl. into ENGLISH of 'Diffusion Raman Anti-Stokes Coherente au Voisinage des Resonances Electroniques et Realisation d'un Montage Exptl. 'ONERA, Paris Report ONERA-NT-1976-6, 1976 Original report in FRENCH previously announced as ESA-98560
(ESA-TT-371; ONERA-NT-1976-6) Avail: NTIS HC A06/MF A01

The application of spectroscopy to gas by coherent anti-Stokes Raman scattering (CARS) is discussed. The characteristic features of CARS are reviewed along with the latest achievements. The use of electronic resonances is then sought for improving the detectivity of this method. Different cases of resonant excitation can be inferred from the quantum mechanical expression of the susceptibility. In each case, the difficulties associated with resonant CARS are pointed out, and detectivity improvement is estimated from resonant spontaneous Raman scattering data. The experiment set up incorporating two tunable dye lasers is described. Author (ESA)

N77-24218# Little (Arthur D.), Inc., Cambridge, Mass.
CHRIS/HACS CHEMICAL PROPERTY FILE
E. Atkinson Dec. 1976 905 p
(Contract DOT-CG-24655-A)
(AD-A034607; USCG-D-124-76) Avail: NTIS HC A99/MF A01 CSCL 07/2

This report represents a listing of the Chemical Properties File which is an integral part of the Hazard Assessment Computer System (HACS). This file contains the physical and chemical properties of some 900 chemical substances; as many as 74 properties may be recorded for each chemical. The properties contained in the file may be either exact values from the chemical literature or estimated values obtained by the use of standard estimation techniques. An '(E)' following a value indicates it is an estimated value; all others are exact. The properties, their code names and their ordering on the file are given at the beginning of this report. All numeric data are listed in SI units. GRA

N77-24219# New York Univ., N. Y. Dept. of Chemistry.
PHOTOELECTRON SPECTROSCOPY OF LIQUIDS UP TO 21.2 eV
Ladislav Nemec, Hans Jasper Gaehrs, Lucille Chia, and Paul Delahay Dec. 1976 38 p refs
(Contract N00014-75-C-0397)
(AD-A034860; TR-5) Avail: NTIS HC A03/MF A01 CSCL 20/8

Photoelectron spectroscopy of liquids is investigated at variable photon energy up to 10 eV and with rare-gas resonance lines at 11.7 (ArI), 16.8 (NeI), and 21.2 (HeI) eV. Seven liquids are studied: N-methylaniline, N,N'-dimethyl-p-toluidine, formamide, hexamethyl phosphoric triamide, tetraglyme, ethylene glycol, and n-decanol. Energy distribution curves display at the higher photon energies a band structure matching the sequence of bands in the corresponding gas-phase photoelectron spectra. The bands are attributed to emission of unscattered electrons (no loss of kinetic energy to the liquid), whereas the underlying background is ascribed to scattered (in the liquid) electrons. Quantitative treatment based on this interpretation agrees with experiment. Energies characterizing either bulk or surface photoionization are determined within + or - 0.1 eV. The gas-liquid red shift (0.9 to 1.4 eV) and bulk-surface blue shift (0.5 to 1.3 eV) in photoionization energies are interpreted in terms of electronic

polarization of the liquid medium. This is, to our knowledge, the first investigation of liquids by ultraviolet photoelectron spectroscopy above 10 eV. Author (GRA)

N77-24220# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
DETERMINATION OF CONTAMINANTS IN LESS-FLAMMABLE HYDRAULIC FLUIDS Final Report
Robert G. Jamison Sep. 1976 22 p
(AD-A034751; MERADCOM-2192; F-662611-AH69) Avail: NTIS HC A02/MF A01 CSCL 11/8

The introduction of a new, less-flammable, synthetic-base hydraulic fluid (MIL-H-46170) for armored vehicles operating in hostile environment created a problem in the operability of the M60 A1 (AOS) hydraulic and gun-control system. In the determining of problem origin, a need was created for methodology to (1) determine the level of MIL-H-6083 petroleum-base hydraulic fluid remaining in the system after retro-fit, and (2) determine the amount of adsorbed water. Gas-liquid chromatographic procedures were subsequently developed to accomplish these objectives. Author (GRA)

N77-24221# R and D Associates, Marina Del Rey, Calif.
MIXING AND COMBUSTION MECHANISMS IN HIGH-SPEED FLOWS Final Report, 1 Apr. 1975 - Nov. 1976
R. B. Edelman and P. T. Harsha 1976 13 p refs
(Contract F44620-75-C-0065; AF Proj. 9711)
(AD-A033619; AFOSR-76-1186TR) Avail: NTIS HC A02/MF A01 CSCL 21/2

A modular model for the analysis of turbulent reacting flows in dump combustors has been formulated and preliminary calculations have been carried out. The methodology involves coupling a stirred reactor model for the recirculation zone(s) to a parabolic mixing model for the directed flow outside of the recirculation zones. This modular model includes the finite-rate formulations of Edelman and the turbulent kinetic energy turbulence models of Harsha. Elements of the model have been compared with available experimental data and other predictions. The results of the comparison have shown that the model is capable of accurate predictions of turbulent reacting flows. Additional work has included the submission of a series of recommended tests to WPAFB/AFAPL. These tests are designed to get data of direct practical use as well as data needed for model development. Steady-state combustion performance and flame stabilization as functions of fuel type, injector location and type, direct injection into the base recirculation zone, and inlet flow state are included. Measurements include pressures, temperatures, flow rates, concentrations, and thrust as well as direct observation of flame blowout (stabilization). Finally, recommendations for future work have been defined. These include further development of the modular model and the initiation of a unified model. In addition, it is recommended that consideration be given to the impact that the use of alternate (non-petroleum) fuels will have on the combustion characteristics of advanced combustor concepts. Author (GRA)

N77-24222# Aeronautical Research Associates of Princeton, Inc., N. J.
A PRELIMINARY INVESTIGATION OF VELOCITY-COUPLED EROSIVE BURNING Interim Report, 1 Oct. 1975 - 30 Sep. 1976
Robert A. Beddini, Ashok K. Varma, and E. Stokes Fishburne Nov. 1976 25 p ref
(Contract F44620-76-C-0016; AF Proj. 6813)
(AD-A032895; ARAP-290; AFOSR-TR-76-1252) Avail: NTIS HC A02/MF A01 CSCL 21/2

Some aspects of the velocity-coupled erosive burning of solid propellants have been examined. The turbulent flowfield is shown to be an important aspect of the overall problem, and is modeled using an extension of the second-order closure scheme originally developed by Donaldson. A simple preliminary flame model -- that of homogeneously mixed reactants proceeding through a single step reaction -- has been coupled to the surface recession mechanism used by Summerfield. Results for varying core velocity indicate an apparent threshold, above which erosive burning occurs. This threshold velocity is coincident with the turbulence layer descending to a position just inside the flame zone. An appreciable increase in burning rate was observed with the presence of a relatively small turbulence level in the flame zone. The erosion ratio, as a function of core velocity, is qualitatively similar to classical descriptions. The results indicate that quantitative agreement with experimental erosive burning rates may be possible with the implementation of propellant combustion mechanisms at a level consistent with the turbulence closure approach. GRA

N77-24223# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ION IMPLANTATION IMPURITY ANALYSIS BY GLOW DISCHARGE OPTICAL SPECTROSCOPY M.S. Thesis
David S. Hake Dec. 1976 85 p refs
(AD-A034007; GEP/PH/76D-5) Avail: NTIS HC A05/MF A01 CSCL 20/12

The Glow Discharge Optical Spectroscopy technique was investigated to determine if it could be used to measure total impurity concentration profiles in unannealed ion implanted GaAs. Cadmium, zinc, and magnesium ions, which are common p-type dopants in GaAs, were implanted at energies of 99 keV and 120 keV and fluences ranging from 10 to the 14th power to 10 to the 16th power ions/sq cm. The implanted GaAs samples were sputtered in a low pressure dc glow discharge using argon gas. Intensity of a strong emission line, characteristic of the implanted impurity, was monitored as a function of time. This intensity was combined with independently measuring GaAs substrate sputtering rates to calculate total impurity concentration profiles. Uncalibrated concentration profiles were obtained for Zn and Mg in GaAs. None was obtained for Cd. Author (GRA)

N77-24224# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
IGNITION OF A REACTIVE MATERIAL BY HOT GASES
M. Kindelan 15 Nov. 1976 18 p refs
(Grant AF-AFOSR-2535-73; AF Proj. 6813; AF Proj. 9711)
(AD-A034858; SR-2; AFOSR-77-0004TR) Avail: NTIS HC A02/MF A01 CSCL 21/2

An asymptotic analysis is developed, describing ignition of a reactive solid suddenly exposed to hot gases. It is found that in the limit of high activation energy of the Arrhenius exothermic reaction, the chemical heat release occurs in a thin diffusive-reactive layer near the surface. The solution for this inner layer is then matched to the solution for the outer transient-diffusive region. An explicit formula for the ignition time is obtained. GRA

N77-24225# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
GASIFICATION EFFECTS IN THE HETEROGENEOUS IGNITION OF A CONDENSED FUEL BY A HOT GAS
M. Kindelan and A. Linan 8 Nov. 1976 29 p refs Sponsored in part by European Office of Aerospace Res. and Develop., London, Engl.
(Grant AF-AFOSR-2535-73; AF Proj. 6813; AF Proj. 9711)
(AD-A034859; SR-1; AFOSR-77-0002TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

An analysis is presented to describe the heterogeneous ignition of a condensed fuel suddenly exposed to a hot oxidizing atmosphere. The exothermic heterogeneous reaction, generating gaseous products, is considered to be of the Arrhenius type with an activation energy large compared with the initial thermal energy of the fuel. Instantaneously after a contact with the gases the surface temperature rises to a jump value which is calculated allowing for variable transport properties of fuel and gas. The effect of the chemical heat release and the cooling effect due to the gasification flow are taken into account in obtaining an integral equation, involving a single parameter delta, which is solved to describe the evolution of surface temperature with time. A runaway in surface temperature is found to occur at a well defined ignition time, which is calculated as a function of delta. For values of delta above a critical value no ignition occurs because the cooling effects of the gasification flow dominate over the effects of chemical heat release. GRA

N77-24226# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
COMBUSTION AND FLAME PROPAGATION IN HETEROGENEOUS SYSTEMS Final Report, 1 Jun. 1972 - 30 Jun. 1976

Antonio Crespo 29 Oct. 1976 25 p refs
(Grant AF-AFOSR-2253-72)
(AD-A033936; AFOSR-76-1420TR) Avail: NTIS HC A02/MF A01 CSCL 21/8

This report first summarizes the works carried out on unsteady effects in droplet evaporation and combustion and on the behaviour of hydrazine catalytic thrusters working under steady state conditions. A topic that is presented in more detail, is on the influence of the temperatures of liquid hydrazine and catalyst particle temperatures on the vacuum start characteristics of a reactor. The model used assumes the existence of a liquid front that first advances towards the interior of the catalyst particle by porous action and then recedes towards the exterior. An order of magnitude estimate seems to indicate that during the process, convective heat transfer dominates over conduction, and the analysis shows the existence of a thin thermal front, whose structure is calculated. Then, the liquid penetration is only governed by the initial particle temperature. For low enough initial particle temperatures the thermal front structure reaches the liquid front and the liquid penetration is also influenced by the initial hydrazine temperature. GRA

N77-24227# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.
MOLECULAR STUDIES OF GASEOUS OXIDES Final Report, 1 Jul. 1975 - 30 Sep. 1976
Edmond Murad and Y. Tanaka 20 Sep. 1976 20 p refs
(AF Proj. 6690)
(AD-A033675; AFGL-TR-76-0213; AFGL-ERP-577) Avail: NTIS HC A02/MF A01 CSCL 07/4

A surplus high temperature mass spectrometer has been successfully refurbished and put into operation. Preliminary measurements of the dissociation energy of gaseous praeseodymium monoxides gave the value of 175.9 plus or minus 3 kcal/mol (or 7.65 plus or minus 0.13 eV). Final analysis of the results on the dissociation energy of gaseous europium monoxide gave the value of 111.9 plus or minus 2.4 kcal/mol (or 4.85 plus or minus 0.10 eV). Preliminary measurements on the vacuum ultraviolet spectra of molecules formed with mixtures of argon-oxygen and of krypton-oxygen have been performed. In the case of Kr - O2 five continua with peaks at 1490A, 1830A, 2090A, 2320A, and 2520A, are observed. Author (GRA)

N77-24228# National Bureau of Standards, Washington, D. C. Chemical Kinetics Information Center.
CHEMICAL KINETICS OF THE GAS PHASE COMBUSTION OF FUELS (A BIBLIOGRAPHY ON THE RATES AND MECHANISMS OF OXIDATION OF ALIPHATIC C1 TO C10 HYDROCARBONS AND OF THEIR OXYGENATED DERIVATIVES) Final Report, 1902-1975
Francis Westley Oct. 1976 142 p refs
(Contract E(49-1)-3800)
(PB-263122/4; NBS-SP-449; LC-76-608282) Avail: NTIS HC A07/MF A01 CSCL 07D

Rate data for gas phase reactions of combustion and oxidation of aliphatic saturated or unsaturated C1 to C10 hydrocarbons, alcohols, aldehydes, ketones, ethers, peroxides and their free radicals are presented. Decomposition, disproportionation, atom transfer, and recombination reactions of the oxygen containing species noted above are also discussed. GRA

N77-24229# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.
ELECTROCATALYSIS ON NON-METALLIC SURFACES Final Report
A. D. Franklin, ed. Nov. 1976 367 p refs Workshop held at Gaithersburg, Md., 9-12 Dec. 1975 Sponsored in part by NSF and ERDA
(PB-262886/5; NBS-SP-455; LC-76-600062) Avail: NTIS HC A16/MF A01 CSCL 07D

The most recent experimental and theoretical investigations on electrocatalysis on non-metals and related topics were reviewed. The theory of electrocatalysis and related topics; electrochemical processes on non-metallic surfaces; and electrochemistry at solid electrolyte interfaces were some of the topics covered. GRA

N77-24230# Pittsburgh Univ., Pa.
STUDIES ON A MECHANISM FOR SALT REJECTION IN REVERSE OSMOSIS MEMBRANES AS A GUIDE TO IMPROVED MATERIALS FOR DESALINATION OF SEA WATER Final Report, 1 Dec. 1973 - 30 Nov. 1976
1976 82 p refs
(Contract DI-14-30-3241)
(PB-262410/4; OWRT/S-77/2; W77-03290) Avail: NTIS HC A05/MF A01

Studies of the interactions of ions with water in nonaqueous systems are presented in general, and in reverse osmosis membranes in particular. Cellulose acetate membranes which were treated with aqueous salt solutions were studied. The membranes were observed by ESCA (Electron Spectroscopy for Chemical Analysis) and by Flame Emission Spectroscopy. It is shown that sodium ions penetrate and are retained in the membranes, even after rinsing, and that their interaction appears to be particularly strong in the active side of the asymmetrical membranes. GRA

N77-24231# California Univ., Davis. Dept. of Chemistry.
HIGH ENERGY CHEMICAL REACTIVITY Final Technical Report, 15 Oct. 1972 - 31 Dec. 1975
John W. Root 1976 11 p refs
(Grant AF-AFOSR-2460-73; AF Proj. 9538)
(AD-A033995; AFOSR-76-1416TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

Gas-liquid critical constants have been measured for fluorinated ethanes and used to test empirical corresponding states relations for the determination of molecular force constants. These empirical relations appear to be applicable to essentially all substances for which critical data are available. A radio-tracer technique has been developed for the investigation of unimolecular collisional energy transfer for 14CH3CF3 activated by 14CH3 plus CF3 recombination. This method has yielded a significant improvement in sensitivity with respect to existing techniques. It appears to be widely applicable for high accuracy studies of unimolecular reactions. GRA

N77-24232# Texas Univ., Austin. Dept. of Chemistry.
THERMAL DECOMPOSITION OF METHANOL ADSORBED ON MAGNESIA Interim Report, 1 Sep. 1975 - 1 Jan. 1977
David C. Foyt and J. M. White 1 Jan. 1977 31 p refs
(Contract N00014-75-C-0922)
(AD-A034793) Avail: NTIS HC A03/MF A01 CSCL 07/3

The thermal desorption of methanol and its decomposition products from magnesium oxide powder were recorded over the temperature range 300-1123 K. The formation of formaldehyde was observed in small quantities above 438 K. Large quantities of CO and H2 were evolved at 723-900 K, accompanied by smaller amounts of CH4. No ether formation was detected. Methanol desorption was observed below 773 K, with structure in the spectrum revealing at least two different phases of the desorption process. The variation of this structure with initial coverage serves to confirm and clarify previous models for methoxyl on MgO, based on infrared absorption studies. Author (GRA)

N77-24233# Cambridge Univ. (England). Dept. of Physical Chemistry.
THE REACTION OF OXYGEN ATOMS WITH NITRATES Final Technical Report, 30 Mar. 1975 - 8 Nov. 1976
B. A. Thrush and L. F. Salter 8 Nov. 1976 23 p refs
(Grant DA-ERO-75-G-020; DA Proj. 1T1-61102-B-13B)
(AD-A033835) Avail: NTIS HC A02/MF A01 CSCL 07/3

The reaction of oxygen atoms with methyl nitrate and with ethyl nitrate have been studied in a discharge-flow system at temperatures between 294 and 473 K. The initial attack involves abstraction of a hydrogene atom. The activation energy for hydrogen abstraction is not reduced by the fact that the initally formed radical ruptures exothermically to yield aldehyde plus nitrogen dioxide. The reaction mechanism and its relation to alkyl nitrate pyrolyses are discussed briefly. GRA

N77-24234# Chicago Univ., Ill. James Franck Inst.
EXPERIMENTAL AND THEORETICAL STUDIES IN PHOTOCHEMISTRY Final Report, 1 Sep. 1972 - 31 Aug. 1976

Stuart A. Rice Sep. 1976 28 p refs
(Contract F44620-73-C-0005)
(AD-A034065; AFOSR-76-1415TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

The results of four years of research on elementary photophysical and photochemical processes are discussed. Particular attention is paid to intramolecular vibrational relaxation, radiationless processes, the coupling of molecular geometry changes to photochemical reactions and laser induced photochemistry.
Author (GRA)

N77-24235# Southwest Research Inst., San Antonio, Tex.
ENCAPSULATION OF CHEMILUMINESCENT MATERIALS Final Report, 1 May 1975 - 31 Oct. 1976
Leon M. Adams and Chel W. Lew Dec. 1976 34 p refs
(Contract N00014-75-C-0997)
(AD-A033922) Avail: NTIS HC A03/MF A01 CSCL 07/4

A stable capsule containing Oxalume has been developed using a mixture of paraffin wax and an ethylene-vinyl acetate copolymer as the shell material. Dusting the capsules with either finely powdered sodium acetate or poly(vinyl alcohol) activates the capsules so that the Oxalume will chemiluminesce when the capsules are crushed. The sodium acetate is the more potent activator, but the poly(vinyl alcohol) produces a more stable system.
Author (GRA)

N77-24236# Texas Univ., Austin. Dept. of Chemistry.
EXPERIMENTAL AND THEORETICAL STUDIES OF ELECTRON BINDING ENERGIES OF WATER ADSORBED ON ALPHA-ALUMINA Interim Report, 1 May 1975 - 1 Dec. 1976
D. B. Almy, D. C. Foyt, and J. M. White 1 Dec. 1976 22 p refs Submitted for publication
(Contract N00014-75-C-0922)
(AD-A033961) Avail: NTIS HC A02/MF A01 CSCL 07/4

Ultraviolet photoelectron spectra (HeI radiation) have been obtained for a partially hydroxylated surface of single crystal alpha-alumina (0001) and for water chemisorbed on this surface at 298 K. Model calculations using the SCF-X alpha-Sw method have also been performed, and, with their aid, the features of the partially hydroxylated spectra have been assigned. Spectral features associated with additional hydration at 298 K are consistent with the adsorption of strongly bound molecular water.
Author (GRA)

N77-24237# Environmental Protection Agency, Cincinnati, Ohio.
ANALYTICAL METHODS FOR TRACE METALS
Jack Pfaff Jan. 1976 76 p
(PB-263560/5; EPA-430/1-76-002) Avail: NTIS HC A05/MF A01 CSCL 14B

This manual is designed as a course for chemists or technicians of industrial or municipal treatment plants who are required to perform analysis for trace metals. Participants learn theoretical concepts and perform a variety of laboratory determinations. Topics include metal analysis by atomic absorption, flame photometry, and volumetric and colorimetric procedures.
GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-24238 British Library Lending Div., Boston Spa (England).
CORROSION OF BOUNDARY ALLOYS OF LEAD IN A SULPHURIC ACID SOLUTION
V. I. Bryntseva, L. A. Tskhe, V. G. Bundzhe, Yu. D. Dunaev, and D. Z. Kiryakov Mar. 1977 30 p refs Transl. into ENGLISH from Tr. Inst. Khim. Nauk, Akad. Nauk Kaz. SSR (USSR), v. 21, 1969 p 3-22
(BLL-RTS-9751) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

The electrochemical behavior of binary systems of lead with silver, antimony, bismuth, and thallium was investigated and compared. It is shown that the corrosion resistance of lead alloys is directly related to the resistance of the components in the medium concerned. In the case of anode polarization, both the structural factor, and the electrochemical-catalytic action of metals and their compounds on the electrode process must be included in calculating corrosion resistance.
Author

N77-24239 British Library Lending Div., Boston Spa (England).
ANODIC BEHAVIOUR OF LEAD-BASED AND OTHER METALLIC ALLOYS IN AQUEOUS SOLUTIONS
Yu D. Dunaev Mar. 1977 16 p refs Transl. into ENGLISH from Kataliticheskie Reaktsii v Zhidkoi Faze: Tr. 2 Uses. Konf. Alma - Ata, 1967 p 388-394
(BLL-RTS-9792) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The stability of various metals, their alloys, and combinations, used in anodic processes, under drastic oxidation conditions is considered. Polarization curves for titanium, tantalum, and iron, the electrochemical properties of these metals after coating with a platinum, layer, and relationships in the change in stability of lead as a result of alloying are among the factors discussed. It is concluded that elements having catalytic properties have an effect on the electrochemical behavior of the anode and its stability, independently of whether they exist in the composition of the alloy, as powder systems in the form of coatings, or as ions in solution. Thus, it is possible to prepare anode systems with a definite range of catalytic and electrochemical properties. J.M.S.

N77-24240 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF THE PASSIVATING ACTION OF CHROMATE PIGMENTS ON IRON
N. I. Savitskaya et al Apr. 1977 10 p Transl. into ENGLISH from Lakokroscoch. Mater. Ikh Primen. (USSR), no. 1, 1972 p 31-33
(BLL-RTS-10571) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The action of chromate pigments on steel was investigated. The passivating ability of the pigments from the shift in the stationary potential of the steel in aqueous extracts was estimated, and a change in the rate of corrosion was determined gravimetrically. Anodic polarization curves characteristing the behavior of iron in buffer solutions in also shown. It was established that the anodic behavior of iron in extracts of chromate pigments is wholly determined by the action of the CrO4(-2) anion which ensures passivation of iron at a concentration of 0.0003 M. It was shown that the passivation of iron does not depend on the nature of the cation present in the pigment.
Author

N77-24241 British Library Lending Div., Boston Spa (England).
OXIDATION OF COPPER AND THE SOLUBILITY OF OXYGEN IN THE METAL
F. Bouillon, G. VanDerSchrick, and C. Kaeckenbeeck-VanDerSchrick Apr. 1977 12 p refs Transl. into ENGLISH from Acta Met., v. 10, no. 7, 1962 p 647-652
(BLL-RTS-10580) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The results of isothermal oxidation were interpreted by taking into account two distinct and conflicting effects: the formation of the oxide at the surface and its dissolution in the metal. Their relative importance was evaluated by comparing the results obtained by gravimetry with those obtained by electrochemical reduction. The effect is practically zero at temperatures below 250 C where the solubility of the oxygen is negligible. The difference between the amounts of oxide present at the surface and the amounts corresponding to the oxygen consumed becomes pronounced at higher temperatures (above 500 C).
Author

N77-24242 British Library Lending Div., Boston Spa (England).
PRACTICAL RESULTS OF CHEMICAL PLANTING WITH AMINOBORANE BATHS
W. Frick Apr. 1977 13 p refs Transl. into ENGLISH from Galvanotechnik (Saaulgau, W. Ger.), v. 67, no. 9, 1976 p 730-734
(BLL-RTS-10606) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Phosphorous-free nickel deposits on metals are obtained using

sodium boranate at plating rates of 20 to 30 micron/h and to virtually any coating thickness. These nickel deposits have excellent hardness after deposition, a capacity for hardening by subsequent heat treatment, a good corrosion resistance, abrasion resistance, and good sliding capacity. The boron hydride baths must be operated at temperatures of 90-95 C, and the pH value must not descend below 12. Reducing agents suitable for chemical metal plating and their application conditions are given in tables. A.R.H.

N77-24243 British Library Lending Div., Boston Spa (England).
METHODS FOR CYCLICAL STRENGTH TESTING OF REFRACTORY METALS IN A VACUUM AT HIGH TEMPERATURES
M. G. Velmakin, A. M. Melnik, and G. F. Sinitsyn Jan. 1977 6 p refs Transl. into ENGLISH from Svetotekhnika (USSR), v. 5, 1973 p 14-15
(BLL-RTS-10482) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The magnetic field of a solenoid is used for loading test pieces in a vacuum apparatus designed for determining the fatigue strength of tungsten wire at high temperatures. Provision is made for different forms of tensile testing: static, alternating, and static with cyclic superposed. The magnitude of the load is determined by the value of the solenoid current. Author

N77-24244 British Library Lending Div., Boston Spa (England).
THEORY AND TECHNIQUE OF LACQUERING ALUMINUM FOIL
J. Bastide [1976] 8 p Transl. into ENGLISH from Papiers, Cartons, Complexes (France), 15 Jun. 1970 p 13-16
(BLL-M-24829-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Lacquers used to coat aluminum are classed as colorless and non-weldable, colored, and thermosetting. The properties of each class of products are described and methods for their application discussed. The techniques include coating baths, continuous coloring on the counter-sizing by flexography or photogravure, and the thermosticking of dry lacquer film. A.R.H.

N77-24245 British Library Lending Div., Boston Spa (England).
ECONOMICS AND ORGANIZATION OF METALLURGICAL PRODUCTION: EFFECTIVENESS OF THE USE OF MAGNETIC FIELDS IN MELTING ALLOY STEELS
I. I. Ivanov, L. F. Vorobeva, and G. V. Bergauz [1976] 7 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 5, 1976 p 183-185
(BLL-M-25473-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The technical and economic effectiveness of using a magnetic field from a solenoid for remelting alloy steels in a water-cooled mold beneath a layer of flux was investigated. When ball bearing, structural, stainless, and heat resistant steels are remelted in a magnetic field the quality of the metal is improved. Heat duration is reduced by 1.0-1.3 h, the specific electric power consumption is reduced 15-20%, and furnace delivery is raised by 18-25%. The reduction in the cost of ingots is, depending on the grade of steel, 1.6-4.0%, while the specific capital outlay on the remelting plant is reduced by 15-20%. Author

N77-24246 British Library Lending Div., Boston Spa (England).
METAL PHYSICS: FORMATION AND STRUCTURE OF SIMPLE METALLIC LIQUIDS ON THE BASIS OF ELECTRON-IC-IONIC INTERACTION
E. S. Filippov [1976] 25 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 5, 1976 p 137-144
(BLL-M-25471-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Heat content, sublimation energy, and ionization and Fermi energy are calculated at the boiling point for 15 single and multiple valence metals using the nonadjustable potential of interaction between the valence electrons and the ion nucleus. At the boiling point, the atoms of liquid are statistically packed, there is no degree of aggregation, and interaction is limited to the closest 6.5-4.5 neighbors. The electrons are excited to a state where all the free volume may be occupied. Therefore, at the boiling point, a liquid can be taken at a zero approximation similar to an ideal gas for gases. Author

N77-24247 British Library Lending Div., Boston Spa (England).
SURFACE TEMPERATURE OF THE METAL DURING A PLASMA MELT
A. V. Laktionov, A. Ya. Stomakhin, and V. A. Grigoryan [1976] 7 p refs Transl. into ENGLISH from Izv. VUZ Chernaya Met. (USSR), v. 5, 1976 p 72-77
(BLL-M-25468-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Brilliance pyrometry is used to study the temperature field on the surface of the molten iron in the plasma arc zone in laboratory conditions by filming the b bath the moment the current is switched off. The temperature measurement error was found to be no greater than 60 degrees. Increasing the argon flow rate raised the maximum metal surface temperature from 1950 to 2050 C in the arc zone. Adding 9.1 percent nitrogen to the argon was accompanied by an increase in electric power from 3.24 to 3.60 kW and raised the maximum temperature from 1970 to 2050 C. A further increase in the nitrogen content of the gas from up to 21.6 to 30 percent raised the maximum temperature from up to 2150 to 2250 C without any further change in power. Author

N77-24248 British Library Lending Div., Boston Spa (England).
EFFECTS OF TEMPERATURE, AND OF PLASTIC DEFORMATION, ON THE GAMMA YIELDS ALPHA TRANSFORMATION IN O3Kh13AG19 STEEL AND ITS MECHANICAL PROPERTIES
E. T. Shinkarenko, V. G. Khoroshailov, G. N. Grikurov, N. P. Antropov, and I. S. Demchuk [1976] 7 p refs Transl. into ENGLISH from Izv. VUZ (USSR), v. 8, 1976 p 105-106
(BLL-M-25505-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The gamma yields alpha transformation and mechanical properties of O3Kh13AG19 steel were investigated with relation to test temperature and the degree of plastic deformation. The extent of the transformation increases as the degree of plastic deformation is increased, and as the temperature is lowered from +20 to -196 C. The mechanical properties were determined at +20, -78, -196, and -253 C. Author

N77-24249 British Library Lending Div., Boston Spa (England).
CONTRIBUTION TO THE THEORY OF RAPID HEATING AND RAPID COOLING OF STEEL
H. Schlicht 26 Nov. 1976 26 p refs Transl. into ENGLISH from Haeterei Tech. Mitt. (West Ger.), v. 29, no. 3, 1974 p 184-192
(BLL-OA-Trans-1554-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

The effect on steel of rapid heating by brief action of laser or electron beams, by electrical energy, by plastic deformation of the crystal lattice, and of high hydrostatic pressures and elastic and plastic strains of the crystal lattice is discussed. The influence on the phase equilibria and phase transformations and on solution and precipitation processes is emphasized. The properties of the rapidly heat treated and cooled structures are described. Author

N77-24250*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIFFUSION WELDING OF A DIRECTIONALLY SOLIDIFIED GAMMA/GAMMA PRIME - DELTA EUTECTIC ALLOY
Thomas J. Moore May 1977 12 p refs
(NASA-TM-X-3514; E-8755) Avail: NTIS HC A02/MF A01 CSCL 11F

Hot-press diffusion welding parameters were developed for a directionally solidified, gamma/gamma prime-delta eutectic alloy. Based on metallography, a good diffusion weld was achieved at 1100 C under 34.5 MPa (5 ksi) pressure for 1 hour. In addition, a dissimilar metal weld between gamma/gamma prime-delta and IN-100 was successfully made at 1100 C under 20.7 MPa (3 ksi) pressure for 1 hour. Author

N77-24251# Council for Scientific and Industrial Research, Pretoria (South Africa).
A CONTRIBUTION TO THE STUDY OF THE IMPROVEMENT OF ABRASION-RESISTANT AUSTENITIC MANGANESE STEEL

F. J. Maratray and T. E. Norman 1976 45 p refs Transl. into ENGLISH from Rev. Met. (Paris), v. 58, 1961 p 489-506 (CSIR-Trans-1323) Avail: NTIS HC A03/MF A01

The life expectancy of cones of rotating mills made of 12Mn-2Mo steel with dispersed carbides was shown superior by 50% to that of classic Hadfield steel. Higher carbon content increases its life expectancy further. Steels with low manganese content stabilized with molybdenum, 6Mn-1Mo were also used as gouging abrasion resistant when the intensity of the shocks was not very high. As regards grinding abrasion, these types of steel have an abrasion resistance comparable to that of Ni-Hard white iron. Author

N77-24252*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CREEP AND TENSILE PROPERTIES OF SEVERAL OXIDE-DISPERSION-STRENGTHENED NICKEL-BASE ALLOYS AT 1365 K

J. Daniel Wittenberger Washington May 1977 24 p refs (NASA-TN-D-8422; E-8882) Avail: NTIS HC A02/MF A01 CSCL 11F

The tensile properties at room temperature and at 1365 K and the tensile creep properties at low strain rates at 1365 K were measured for several oxide-dispersion-strengthened (ODS) alloys. The alloys examined included ODS Ni, ODS Ni-20Cr, and ODS Ni-16Cr-Al. Metallography of creep tested, large grain size ODS alloys indicated that creep of these alloys is an inhomogeneous process. All alloys appear to possess a threshold stress for creep. This threshold stress is believed to be associated with diffusional creep in the large grain size ODS alloys and normal dislocation motion in perfect single crystal (without transverse low angle boundaries) ODS alloys. Threshold stresses for large grain size ODS Ni-20Cr and Ni-16Cr-Al type alloys are dependent on the grain aspect ratio. Because of the deleterious effect of prior creep on room temperature mechanical properties of large grain size ODS alloys, it is speculated that the threshold stress may be the design limiting creep strength property. Author

N77-24253*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF SIMULATED EARTH REENTRY EXPOSURE ON MECHANICAL PROPERTIES OF SEVERAL OXIDE DISPERSION STRENGTHENED AND SUPERALLOY SHEET MATERIALS

J. Daniel Whittenberger Washington May 1977 67 p refs (NASA-TN-D-8493; E-9062) Avail: NTIS HC A04/MF A01 CSCL 11F

The effects of simulated multiple reentry into the earth's atmosphere on the mechanical properties of several high temperature metallic sheet materials were evaluated. The materials included five tin-gage (nominally 0.025- or 0.037-cm) oxide dispersion strengthened (ODS) alloys and two thin-gage (nominally 0.037-cm) superalloys. Multiple reentry conditions were simulated through cyclic Plasma Arc Tunnel (PAT) exposure. PAT exposure generally consisted of 100 cycles of 600 second duration at 1255, 1366, or 1477 K in a Mach 4.6 airstream with an impact pressure of nominally 800 N/m2. PAT exposure generally produced a uniform oxide scale, oxide pits or intergranular oxidation, Kirkendall porosity, and alloy depletion zones except for the aluminum-containing ODS alloys. Only a uniform oxide scale was formed on the aluminum-containing ODS alloys. PAT exposure did not significantly affect the mechanical properties of the thin-gage (nominally 0.025- or 0.037-cm) alloys evaluated. Thus it appears that the microstructural changes produced by Plasma Arc Tunnel exposure has little influence on mechanical properties. Author

N77-24254*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH TOUGHNESS-HIGH STRENGTH IRON ALLOY Patent Application

J. R. Stephens and W. R. Witzke, inventors (to NASA) Filed 6 Jun. 1977 12 p

(NASA-Case-Lew-12542-1; US-Patent-Appl-SN-803822) Avail: NTIS HC A02/MF A01 CSCL 11F

A steel alloy is provided which exhibits excellent strength and toughness characteristics at cryogenic temperatures. The alloy consists essentially of about 10 to 16 percent by weight nickel, about 0.1 to 1.0 percent by weight aluminum, and 0 to about 3 percent by weight of at least one of the following additional elements: copper, lanthanum, niobium, tantalum, titanium, vanadium, yttrium, zirconium and the rare earth metals, with the balance being essentially iron. The steel alloy is produced by a process which includes using cold rolling at room temperature and subsequent heat treatment at temperatures ranging from 500 to 650 C, and possesses a fracture toughness ranging from 200 to 230 ksi and yield strengths up to 230 ksi. NASA

N77-24255# Idaho National Engineering Lab., Idaho Falls.

CORROSION OF STAINLESS STEEL TYPE 304 ALLOYED WITH BORON OR GADOLINIUM BY PLANT PROCESS SOLUTIONS CONTAINING HNO3 AND HF

H. S. Cole Sep. 1976 28 p refs

(Contract E(10-1)-1375)

(ICP-1097) Avail: NTIS HC A03/MF A01

The coprocessing of aluminum and zirconium clad fuel elements, for the recovery of U235, utilizes highly corrosive solutions containing both nitrates and fluorides. These solutions may contact Type 304 stainless steel alloyed with boron or gadolinium for criticality safety. Corrosion tests, utilizing synthetic process solutions typical of plant operation, were conducted on four stainless steel alloys to determine any differences in corrosion due to the neutron absorbers alloyed 0.3 or 1.5 percent B, or 0.3 percent Gd into the steel. The use of zirconium as a chemically sacrificial metal and complexing with aluminum nitrate were also evaluated for corrosion mitigating ability. Corrosion rates were found to vary directly with the amount of neutron absorbing alloy present but could be reduced by utilizing B10 for alloying instead of natural boron. Zirconium metal or aluminum nitrate for complexing HF solutions were not as effective for corrosion control as reducing the neutral poison content in the alloy. Author (ERA)

N77-24256# Tel-Aviv Univ. (Israel).

ISOTOPE EFFECT IN THE SORPTION OF HYDROGEN ON TITANIUM

Paulina Millenbach Jun. 1976 50 p refs Transl. into ENGLISH of M.S. Thesis, Tel Aviv Univ., Sep. 1974, INIS-MF-1685

(UCRL-Trans-11111; LLL-02145) Avail: NTIS HC A03/MF A01

Protonic, covalent, and hydrogen anion models were used to investigate the chemical bonds in titanium hydrides. Thermodynamic quantities in the titanium hydrogen system were determined from dissociation pressures of the hydrides. There is some evidence that the dissociation pressures of the deuterides are higher than those of the corresponding hydrides. The absorption of mixtures and exchange of one isotope for the other were studied to determine the existence of a definite isotope effect. The exchange energy is 0.5 kcal/mole. ERA

N77-24257# Hanford Engineering Development Lab., Richland, Wash.

DEPENDENCE OF IRRADIATION CREEP ON TEMPERATURE AND ATOM DISPLACEMENTS IN 20% COLD WORKED TYPE 316 STAINLESS STEEL

E. R. Gilbert Apr. 1976 23 p refs Presented at Intern. Colloq. on Meas. of Irradiation Enhanced Creep in Nucl. Mater., Petten, Neth., 5 May 1976

(Contract E(45-1)-2170)

(HEDL-SA-824; Conf-760530-6) Avail: NTIS HC A02/MF A01

Irradiation creep studies with pressurized tubes of 20 percent cold worked Type 316 stainless steel conducted in EBR-2 show that as atom displacements are extended above 5 dpa and temperatures are increased above 375 C, the irradiation induced creep rate increases with both increasing atom displacements and increasing temperature. The stress exponent for irradiation induced creep remains near unity. Irradiation-induced effective creep strains up to 1.8 percent were observed without specimen failure. ERA

N77-24258# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.

POSITRON STUDIES OF FATIGUE, HYDROGEN EMBRIT-

TLEMENT AND RADIATION DAMAGE IN METALS
J. G. Byrne, P. Alexopoulos, F. Alex, T. D. Hadnagy, R. Waki, G. R. Miller, and R. W. Ure 1976 7 p refs Presented at 4th Intern. Conf. on Positron Annihilation, Helsingor, Den., 23 Aug. 1976
(Contract E(11-1)-2128)
(CONF-760848-1) Avail: NTIS HC A02/MF A01

Polycrystalline copper was followed in both cyclic softening and hardening with positron lifetime and x-ray particle size measurements. As initially hard copper is fatigue cycled, the mean positron lifetime decreases while the x-ray particle size increases. Similar correlation exists during fatigue hardening of initially soft copper. The trends indicate a positron response to decreasing dislocation density during fatigue softening and the converse during fatigue hardening. Hydrogen embrittlement effects in AISI 4340 steel and nickel were followed with mean positron lifetime. It appears that the effects are caused by mutual interaction of dislocations, protons, and positrons. In single crystal copper irradiated at 80 K and 4.5 MeV electrons, about 8 percent of the defects produced appear to be divacancies and the balance simple Frenkel defects. ERA

N77-24259# California Univ., Livermore. Lawrence Livermore Lab.
CRYOFORMING EVALUATION USING HIGH-PURITY NICKEL
D. E. Lord and L. F. Meisner 14 Sep. 1976 29 p refs
(Contract W-7405-eng-48)
(UCID-17265) Avail: NTIS HC A03/MF A01

Fast and slow strain rates were used in forming samples of 270 nickel at cryogenic and room temperatures. All samples were measured for failure strength at room temperature, and their strength preparation elongation curves compared at equal temperatures and strains. Cryoforming produced a 30 percent higher-strength nickel than that produced at room temperature at equal strains and strain rates. Forming rate effects disappeared as working temperature decreased. Rate-insensitive cryoforming produced a considerably stronger room-temperature material than room-temperature forming at high strain rates. Transmission electron microscopy indicates apparent structural differences between cryoformed and room-temperature-formed nickel. ERA

N77-24260# California Univ., Livermore. Lawrence Livermore Lab.
TENSILE PROPERTIES OF WELDED OR SENSITIZED 316 STAINLESS STEEL IN HIGH-PRESSURE HYDROGEN GAS
E. L. Raymond and R. R. Vandervoort 8 Sep. 1976 10 p refs
(Contract W-7405-eng-48)
(UCRL-52128) Avail: NTIS HC A02/MF A01

The effect of high-pressure hydrogen gas on the tensile properties of welded or sensitized 316 stainless steel was studied to find out if hydrogen embrittlement occurs. Tensile tests on unnotched and notched specimens in air, 70-MPa helium and 70-MPa hydrogen were conducted, using the air test results as baseline tensile properties. Results show that all specimens had good ductilities and were not notch-sensitive in high-pressure hydrogen. Fractographs reveal classic ductile-dimple failure in all specimens, but no evidence of hydrogen embrittlement. ERA

N77-24261# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
OPTIMIZATION OF STRENGTH AND DUCTILITY IN Fe-Mn TRIP STEELS
G. T. Haddick Jun. 1976 63 p refs
(Contract W-7405-eng-48)
(LBL-3986) Avail: NTIS HC A04/MF A01

The Fe-Mn alloys contained 16 to 20 percent Mn, 0 to 0.15 percent C, and 0 to 1.0 percent Mo. The mechanical properties of TRIP steels at room temperature depend on the M/sub s/ and M/sub d/ temperatures. In general, the strength and ductility of the 16 percent Mn steels improved with increasing alloy content while the 20 percent Mn alloys were less sensitive to increased alloy content. As the chemical composition was increased, the phase composition tended toward more epsilon martensite. This increase in the epsilon martensite content indicated that the M/sub d/ temperature was decreasing towards room temperature, and the effect of the decreasing M/sub d/ temperature showed itself in the variation of the mechanical properties. The 16 percent Mn alloy showed a 30 ksi yield strength and 30 percent elongation while the 16 percent Mn-0.08 percent C-1.0 percent Mo alloy had a 46 ksi yield strength and 46 percent elongation. ERA

N77-24262# Battelle Pacific Northwest Labs., Richland, Wash.
CRACK PROPAGATION SURVEILLANCE BY STRESS WAVE EMISSION USING A CONVERTED LEANORD LOCALIZER
E. G. Tomachevsky Feb. 1976 7 p Transl. into ENGLISH from Bull. Inf. Sci. Tech. (Paris), no. 211, Feb. 1976 7 p
(Contract E(45-1)-1830)
(BNWL-TR-192) Avail: NTIS HC A02/MF A01

Observation of the progress of a crack by detection of stress wave emission (SWE) is perturbed by mechanical parasites from the trail equipment and also by electrical parasites. Since these parasites are perfectly localized they can be eliminated by means of a localizer, if special adjustments are made and the apparatus is slightly modified. ERA

N77-24263# Oak Ridge Gaseous Diffusion Plant, Tenn. Dept. of Chemical Analysis.
FORMATION OF CORROSION-RESISTANT OXIDE FILM ON URANIUM
G. S. Petit 15 Oct. 1976 21 p refs Presented at the Integrated Contractors Meeting on Coatings and the Joint Working Group 12A Coating Meeting, Livermore, Calif., 25-28 Oct. 1976
(Contract W-7405-eng-26)
(K/TL-613; Conf-761048-1) Avail: NTIS HC A02/MF A01

A vacuum heat treatment method was developed for coating metallic uranium with an adherent protective film of uranium oxide. The film is prepared by vacuum heat treating the metallic uranium at 625 C for 1 h while controlling the amount of oxygen being metered into the furnace. Uranium coupons with the protective film were exposed for several hundred hours in a corrosion test bath at 95 C and 100 percent RH without corroding. Film thicknesses ranging from 5 to 25 micrometers (0.0002 to 0.001 in.) were prepared and corrosion tested; the film thickness is controlled to less than + or - 2.5 micrometers (+ or - 0.0001 in.). The oxide film is hard, nonwetting, and very adherent. The resulting surface finish of the metal is equivalent to that of the original finish. The advantages of the oxide films over other protective coatings are given. ERA

N77-24264# Oak Ridge National Lab., Tenn.
TEMPERATURE GRADIENT COMPATIBILITY TESTS OF SOME REFRACTORY METALS AND ALLOYS IN BISMUTH AND BISMUTH-LITHIUM SOLUTIONS
J. R. DiStefano and O. B. Cavin Nov. 1976 38 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5503) Avail: NTIS HC A03/MF A01

Quartz, T-111, and Mo thermal-convection loop tests were conducted at temperatures up to 700 C to determine the compatibility of several refractory metals/alloys with bismuth and bismuth-lithium solutions for molten salt breeder reactor applications. Methods of evaluation included weight change measurements, metallographic examination, chemical and electron microprobe analysis, and mechanical properties tests. Molybdenum, T-111, and TA-10 percent W were the most promising containment materials, while niobium and iron-based alloys are unacceptable. ERA

N77-24265# Oak Ridge National Lab., Tenn. Chemistry Div.
CORROSIVITY OF GEOTHERMAL BRINES Progress Report
F. A. Posey and A. A. Packo Dec. 1976 35 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5688) Avail: NTIS HC A03/MF A01

The corrosivity of ferrous materials in synthetic geothermal brines was studied. Electrochemical measurements on the spontaneous corrosion potentials and corrosion rates, and on the kinetics of the anodic and cathodic corrosion reactions of iron and carbon steel were made in 4 M NaCl solution over the pH range from 1 to 11 at temperatures up to 100 C in a conventional Pyrex electrochemical cell. A refreshed, stirred titanium autoclave system was designed, constructed, and tested, and will be used for making electrochemical measurements in synthetic brines up to at least 200 C. The effect of pH on

hydrolysis, precipitation, and electrochemical reactivity of ferrous and ferric ions in 4 M NaCl at 25 C was studied, and implications for plant operation are discussed. The pitting potential of Type 304 stainless steel in synthetic brine was measured as a function of temperature from 25 to 85 C. Plans for research on electrochemical aspects of the corrosion of iron and carbon steel in synthetic geothermal brines during FY1977 are presented. ERA

N77-24266# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

STRESS FACTORS FOR THE DEFORMATION SYSTEMS OF ZIRCONIUM UNDER MULTIAXIAL STRESS

D. O. Hobson 12 Nov. 1976 167 p refs

(Contracts W-7405-eng-26; NRC-INA-40-551-75; NRC-INA-40-552-75)

(ORNL-NUREG-10) Avail: NTIS HC A08/MF A01

Calculation of the resolved shear stresses (RSS) that act on various deformation systems in metals and, in particular, the determination of those systems subjected to the highest RSS by a given set of multiaxial stresses is of importance in the study of texture development, yielding and plastic flow. The geometrical influences of any stress state on the deformation modes of zirconium are examined. One slip mode and three twinning modes, comprising twenty-one deformation systems, are considered. Stress factors computed for these systems are shown on a coordinate system that allows specimen orientation, most highly stressed deformation system, and stress factor to be shown without ambiguity. The information allows the determination of the RSS that results from any multiaxial stress state; this information also allows the prediction of the deformation modes that might operate for any specimen orientation in that stress state. ERA

N77-24267# Oak Ridge Y-12 Plant, Tenn.

FRACTURE CHARACTERISTICS OF URANIUM ALLOYS BY SCANNING ELECTRON MICROSCOPY

J. W. Koger and R. K. Bennett, Jr. Oct. 1976 64 p refs

(Contract W-7405-eng-26)

(Y-2063) Avail: NTIS HC A04/MF A01

The fracture characteristics of uranium alloys were determined by scanning electron microscopy. The fracture mode of stress corrosion cracking (SCC) of uranium-7.5 weight percent niobium-2.5 weight percent zirconium (Mulberry) alloy, uranium-niobium alloys, and uranium-molybdenum alloys in aqueous chloride solutions is intergranular. The SCC fracture surface of the Mulberry alloy is characterized by very clean and smooth grain facets. The tensile overload fracture surfaces of these alloys are characteristically ductile dimple. Hydrogen embrittle,ment failures of the uranium alloys are brittle and the fracture mode is transgranular. Fracture surfaces of the uranium-0.75 weight percent titanium alloys are quasi cleavage. ERA

N77-24268# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Reactors Div.

SODIUM TECHNOLOGY PROGRAM COMPONENT MATERIALS COMPATABILITY Quarterly Progress Report

W. E. Ray Oct. 1976 12 p

(Contract E(11-1)-3045)

(WARD-NA-3045-37) HC $3.50 domestic, $6.00 foreign; available from USERDA Technical Information Center, P.O. Box 62, Oak Ridge, Tenn. 37830

Low cycle fatigue results for solution annealed Type 316 stainless steel, tested in flowing sodium at 593 C, were obtained for samples sodium pre-exposed at 593 C for 2,000 and 5,000 h, as well as as-fabricated material. The fatigue life for the as-fabricated material was greatest in all cases, with the difference increasing as the total strain range decreased. In addition, the fatigue life decreased as the sodium pre-exposure time increased. Creep-rupture tests of solution annealed Type 316 stainless steel in flowing sodium at 593 C show that sodium pre-exposure at 593 C for 2,000 and 5,000 h significantly increases the rupture life and ductility of the material. At the same time, the rupture life for the materials pre-exposed 5,000 h is less than that for the material pre-exposed 2,000 h. Results of creep rupture and low cycle fatigue tests in flowing sodium of solution annealed Type 316 stainless steel with various pre-treatments are also included. ERA

N77-24269# Hanford Engineering Development Lab., Richland, Wash.

RELATIONSHIP BETWEEN SWELLING AND ELASTIC PROPERTIES IN NEUTRON-IRRADIATED 316 STAINLESS STEEL

J. F. Bates Apr. 1976 23 p refs Presented at the 8th Symp. of the Am. Soc. for Testing and Materials on the Effect of Radiation on Structural Materials, St. Louis, 3-6 May 1976

(Contract E(45-1)-2170)

(HEDL-SA-1068; Conf-760515-5) Avail: NTIS HC A02/MF A01

The results are presented on elastic property measurements on several alloys, which differ in silicon, molybdenum, and phosphorus contents but have a nominal 316 stainless steel composition. It is shown that there is a good correlation between the initial shear modulus of the material and the resultant swelling rate of that material. It is also shown that the bias factor concept does not satisfactorily account for the observed compositional sensitivity of swelling in the alloys investigated. ERA

N77-24270# Hanford Engineering Development Lab., Richland, Wash.

EFFECT OF STRESS DURING NEUTRON IRRADIATION ON THE MICROSTRUCTURE OF TYPE 316 STAINLESS STEEL

H. R. Brager, F. A. Garner, and G. L. Guthrie Apr. 1976 39 p refs Presented at 8th Symp. of the Am. Soc. for Testing and Materials on the Effect of Radiation on Structural Materials, St. Louis, Mo., 4 May 1976

(Contract E(45-1)-2170)

(HEDL-SA-1064; Conf-760515-7) Avail: NTIS HC A03/MF A01

A transmission electron microscopy (TEM) examination was performed on solution annealed and 20 percent cold-worked Type 316 stainless steel specimens stressed during irradiation at 500 C in EBR-2. Hoop stress levels ranged from 0 to 327 MN/sq m (47,300 psi). Data confirm that applied tensile stresses enhance swelling in the solution annealed steel. The number densities of both voids and Frank loops were sensitive to the stress environment. Total swelling in the annealed material increased with stress, but not in direct proportion to the increased void nucleation. While the effect of cold working was to suppress swelling, the nucleation and growth of Frank loops was unaffected by the cold worked microstructure. The individual planar loop densities within any one specimen were quite sensitive to the magnitude of the stress component normal to the loop plane, while the total loop number density was sensitive to a smaller degree of the magnitude of the hydrostatic stress level. ERA

N77-24271# Sandia Labs., Albuquerque, N. Mex.

CHEMICALLY-TRAPPED HYDROGEN IN CVD Si_3N_4: DEPENDENCE ON NH_3/SiH_4 RATIO AND ON ANNEALING

H. J. Stein and H. A. R. Wegener (Sperry Res. Center, Sudbury, Mass.) 1976 33 p refs Presented at the IEEE Non-Volatile Semiconductor Memory Workshop, Vail, Colo., 17 Aug. 1976

(Contract E(29-1)-789)

(SAND-76-5357; Conf-760851-1) Avail: NTIS HC A03/MF A01

Internal reflectance measurements were used to determine the hydrogen content in as-deposited, thermally annealed, and in hydrogen and deuterium implanted CVD silicon nitride films. The NH band increases with the NH_3/SiH_4 ratio, whereas the SiH band is a maximum in the 100:1 film. Conductance and refractive index of the films decrease with increasing NH_3/SiH_4 ratio. Rapid initial annealing of the NH band is observed at 800 C, whereas the SiH band intensity is maintained in 10:1 and 100:1 films but not in the 1000:1 film. This behavior is interpreted as a transfer of hydrogen from N to Si sites. Hydrogen implantation provides a calibration which indicates approximately 7 at. percent hydrogen in the as-deposited 1000:1 film. Implanted deuterium gives the expected vibrational frequency shift for the absorption band but does not give a mass-dependent shift in annealing for the major loss stage near 900 C, suggesting a bond-energy-limited rather than diffusion-limited hydrogen-loss mechanism. ERA

N77-24272# Battelle Pacific Northwest Labs., Richland, Wash.
COMPARISON OF ION IRRADIATION DAMAGE IN THREE GRADES OF UNALLOYED MOLYBDENUM
E. R. Bradley 12 Aug. 1976 17 p refs Presented at 2d Topical Meeting on the Technol. of Controlled Nucl. Fusion, Richland, Wash., 21 Sep. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5766; Conf-760935-4) Avail: NTIS HC A02/MF A01

Transmission electron microscopy was employed to characterize the ion irradiation damage in three grades of unalloyed molybdenum. The materials were irradiated with 5 MeV Ni(2+) ions at temperatures of 900 and 1000 C. Major differences exist in both the void and dislocation components of the damage and are attributed to differences in the carbon content of the three materials. A model, whereby carbon atoms segregate to small loops and decrease the bias for self interstitials, is used to qualitatively explain the observed variations in microstructure. ERA

N77-24273# Battelle Pacific Northwest Labs., Richland, Wash.
NODULAR CORROSION OF THE ZIRCALOYS
A. B. Johnson, Jr. and R. M. Horton Aug. 1976 28 p refs Presented at Symp. on Zirconium Nucl. Industry, Quebec, Can., 10 Aug. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5735; Conf-760858-1) Avail: NTIS HC A03/MF A01

Oxide nodules form on Zircaloy nuclear components under irradiation. Similar nodules were observed on Zircaloy coupons in cold rolled or extended conditions after autoclave treatments at 475 and 500 C in steam at 1,500 to 1,700 psi. Stages of nodular corrosion in the autoclave were nodule nucleation, growth, coalescence, propagation to accelerated uniform corrosion, and complete specimen oxidation. Observations on BWR fuel rods suggest that a similar progressive attack has occurred; however, in no case has the in-reactor attack progressed to the stage of complete fuel rod failure. Recent autoclave tests confirmed the nodular character of the attack on cold-worked materials. Alpha anneals (up to 790 C) did not consistently suppress the nodular attack. However, alpha + beta (840 C) and beta (1010 and 1040 C) anneals did suppress the attack if followed by a fast cool. The efficacy of the anneals applied similarly to Zircaloy-2 and Zircaloy-4. ERA

N77-24274# Argonne National Lab., Ill.
RADIATION BLISTERING IN METALS AND ALLOYS
S. K. Das and M. Kaminsky 25 Aug. 1975 96 p refs Presented at Symp. on Radiation Effects on Solid Surfaces, Chicago, 25 Aug. 1975
(Contract W-31-109-eng-38)
(CONF-750839-2) Avail: NTIS HC A05/MF A01

Radiation blistering in solids was identified as a process leading to damage and erosion of irradiated surfaces. Some of the major parameters governing the blistering process in metals and some metallic alloys are the type of projectile and its energy, total dose, dose rate, target temperature, channeling condition of the projectile, orientation of the irradiated surface plane, and target material and its microstructure. Experimental results and models proposed for blister formation and rupture are reviewed. A description of methods for the reduction of surface erosion caused by blistering is included. ERA

N77-24275# Sandia Labs., Albuquerque, N. Mex.
STUDY OF DEFECTS IN METALS WITH POSITIVE MUONS
W. B. Gauster, A. T. Fiory, K. G. Lynn, W. J. Kossler, D. M. Parkin, C. E. Stronach, and W. F. Lankford 1976 24 p refs Presented at the Intern. Conf. on Properties on Atomic Defects on Metals, Argonne, Ill., 18 Oct. 1976
(Contract E(29-1)-789)
(SAND-76-9054; Conf-761027-3) Avail: NTIS HC A02/MF A01

The technique of positive muon spin depolarization is reviewed and its sensitivity to the presence of defects in metals discussed. Results are presented of an experimental survey on copper, aluminum, indium and beryllium. Anomalously fast diffusion at all temperatures was observed for aluminum. Results are discussed in the context of muon diffusion. ERA

N77-24276# Bofors A. B. (Sweden).
STUDY OF SUPER ALLOYS PRODUCED VIA POWDER METALLURGY European Concerted Action. Cost 50 - Materials for Gas Turbines. Final Report, Jan. 1973 - Jul. 1975
Lars Hellner and Hans Johansson Jul. 1975 56 p refs Sponsored by Swed. Board of Tech. Develop. Prepared jointly with Brown , Boveri & Co., Baden, Switz.
Avail: NTIS HC A04/MF A01

Superalloys produced via powder metallurgy, were subjected to hot workability tests. Materials include the cobalt-base alloys X 40, MAR M 509, the nickel-base alloy IN 738, and dispersion hardened IN 738. The cobalt base alloys X 40 in the as-HIP condition showed relatively low ductility in hot workability tests. Although very low deformation rates were tested, no signs of superplasticity were found. X 40 in the as-cast condition also showed low ductility. In the same way X 40 HIP, MAR M 509 showed low ductility. HIP X 40 was subjected to heat treatments and stepwise deformation in order to get an improved hot workability; however, none of the treatments had any effective influence. Microscopic investigation of the fractured specimens from both HIP and extruded material showed cracks to be mainly interparticular. This might explain why the ductility is low. From results it is concluded that the cobalt base alloys, produced from inert-gas atomized powder, could not practically be forged or rolled. Hot workability tests were also performed on the nickel base alloy IN 738 in the as-HIP and in the as-cast condition. Very low ductilities were obtained, which is in agreement with literature data on another nickel base alloy, IN 100. Extruded IN 738, dispersion hardened with Y2O3, however, showed good ductility. The tensile behavior was not superplastic, as reported for IN 100, but the values indicate that extruded IN 738 + Y2O3 should be well forgeable. Author (ESA)

N77-24277# Brown, Boveri and Co., Ltd., Baden (Switzerland).
FRACTURE IN DIRECTIONALLY SOLIDIFIED EUTECTIC SUPERALLOYS European Concerted Action. Cost 50 - Materials for Gas Turbines. Final Report, Jul. 1973 - Jun. 1976
R. B. Scarlin and M. O. Speidel Jul. 1976 31 p refs Sponsored by Eidgenoess. Volkswirtschaftsdept.
Avail: NTIS HC A03/MF A01

Creep and fatigue crack growth rates and threshold stress intensity amplitudes were measured for a directionally solidified carbide-eutectic alloy, C73. Fatigue testing temperatures were ambient, 750 and 950 C for cracking perpendicular and parallel to the solidification direction. In the former cracking direction comparative propagation rates may be understood in terms of the properties of the matrix, which shows a phase transformation from hexagonal to cubic above 900 C. Transformation of the M7C3 fibres, present in the as-cast condition, to M23C6 at cell boundaries of the solidification structure occurs at a temperature of 950 C. Although M23C6 carbides are easily cracked and therefore probably reduce propagation rates by causing secondary cracking, their presence is known to be detrimental to creep properties. High cycle fatigue threshold stress intensity amplitudes for C73 in either loading direction at room temperature, 750 C and 950 C are about 20% lower than for cast nickel-base alloy, IN738LC, i.e. critical defect sizes are about 10% smaller in C73. Author (ESA)

N77-24278# Brown, Boveri and Co., Ltd., Baden (Switzerland).
FATIGUE CRACK GROWTH IN NICKEL BASE ALLOYS European Concerted Action. Cost 50 - Materials for Gas Turbines. Final Report, Jul. 1973 - Jun. 1976
R. B. Scarlin and M. O. Speidel Jul. 1976 77 p refs Sponsored by Eidgenoess. Volkswirtschaftsdept.
HC A05/MF A01

Several nickel base alloys were subjected to tests involving mechanical, metallurgical, and environmental parameters in order to determine their cracking resistance. Fatigue crack growth experiments have shown that cracking resistance at high temperatures and stresses can be considerably increased by directional solidification. Creep crack growth rates perpendicular to the solidification direction can also be slightly reduced by

side branching. In a wrought and a cast nickel base alloy, reduction of fatigue testing frequency at elevated temperature results in higher crack growth rates per loading cycle both in air and under vacuum. It has been shown that neither for a wrought nor a cast nickel alloy is it possible to predict low frequency fatigue crack growth rates from a knowledge of high frequency fatigue cracking rates and creep cracking rates. Author (ESA)

N77-24279# European Space Agency, Paris (France).
MARTENSITIC TRANSFORMATIONS IN THE IRON-NICKEL-MANGANESE SYSTEM
Jean Lacomme Mar. 1977 62 p refs Transl. into ENGLISH of 'Transformations Martensitiques dans le Systeme Fer-Nickel-Manganese', ONERA, Paris Report ONERA-NT-1976-7, 1976 Original report in FRENCH previously announced as N77-21221
(ESA-TT-363; ONERA-NT-1976-7) Avail: NTIS HC A04/MF A01

The iron rich part of the phase diagram of the iron-nickel-manganese system was studied at ambient and low temperatures by transmission electron microscopy. It was thus possible to observe the various gamma leads to alpha, gamma leads to epsilon martensitic transformations occurring in this part of the diagram and to measure the temperatures Ms at which the transformation of the prepared alloys starts. It was also possible to study the structure and nucleation of alpha and epsilon martensites, and to verify the orientation relations characteristic of the transformations giving rise to them. The effect of the composition and of Ms on the type of martensite formed was determined. The variation of the stacking fault energy with temperature was also evaluated during the gamma leads to epsilon transformation in the alloy Fe-8 Ni-12 Mn. Some magnetization measurements allowed the points Ms to be determined and these values were compared with those obtained by the electron micrscope. Finally, the phase diagram obtained shows that the austenitic gamma phase is more stable than indicated in previous studies which served as references. This could not be clearly explained. Author (ESA)

N77-24280# Naval Air Engineering Center, Lakehurst, N.J. Ground Support Equipment Dept.
CONTROL OF CORROSION IN GROUND SUPPORT EQUIPMENT Interim Report
E. W. Roberts Sep. 1976 51 p refs
(AD-A033924; NAEC-GSED-106) Avail: NTIS HC A04/MF A01 CSCL 01/5

A summary of efforts to provide guidelines for control of corrosion of ground support equipment. Problem definition and 'state-of-the-art' investigations include findings of surveys of East and West Coast NAS/MCAS/CV sites. A comprehensive Corrosion Key analyzes the extensive photographic record from the survey. Data has been compiled relating to corrosion control methods, materials and equipment for inclusion in a NAVAIR manual specifically oriented for GSE. Author (GRA)

N77-24281# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
INDEXING THE DEGREE OF HYDROGEN EMBRITTLEMENT OF 4340 STEEL USING THE BARNACLE ELECTRODE Progress Report
D. A. Berman 3 Nov. 1976 22 p refs
(WR0220101)
(AD-A034661; NADC-76359-30) Avail: NTIS HC A02/MF A01 CSCL 11/6

The barnacle electrode, an electrochemical device based on the hydrogen permeation method, was used, in conjunction with sustained load tests, to index the degree of embrittlement of 4340 steel. Flat, double notched tensile specimens of 250 ksi (1725 MPa) notched tensile strength and having a K sub T of 5.6 were shown to have a critical diffusible hydrogen concentration of 1.9, 1.7, 1.4, 1.2, 0.9 and 0.5 ppm for loads of 15, 20, 25, 30, 35 and 40 percent of the notched tensile strength. Author (GRA)

N77-24282# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
MICROSTRUCTURE STUDY OF THE EFFECT OF TITANIUM IN THE AGING TREATMENT OF AN Al-Zn-Mg ALLOY
Chun Chen and Gary Judd Dec. 1976 35 p refs
(Contract N00014-75-C-0504)
(AD-A034649; TR-8) Avail: NTIS HC A03/MF A01 CSCL 11/6

A study has been made on the effect of Ti additions on the microstructure in two stage and single stage aging of an Al-5 Zn-2 Mg alloy. The influence of aging treatment was examined for alloys with and without Ti addition. The alloys were solution heat treated at 510 C, air cooled, then aged at various temperatures below the G. P. zone solvus for short times before aging above the G. P. zone solvus at 200 C. The Ti addition alloy yields a small precipitate free zone (PFZ) and a higher density of precipitate near the edge of the PFZ than in the mid-grain region. The ternary alloy without Ti addition produces a wide range of PFZ sizes (0.4 to 4 micron) depending upon the aging temperature below the G. P. zone solvus. Significant changes in the morphology of the matrix precipitate, the amount of grain boundary precipitate, and the width of PFZ were observed in single stage aging at 200 C as a result of the Ti addition. These results could be explained in terms of Ti interacting with vacancies or solute atoms, causing the changes in the vacancy and/or solute concentration profiles. A model based upon solute and vacancy concentrations coupled with a time at temperature effect has been developed to allow the interpretation of the observed two-stage aging results in an Al-Zn-Mg alloy. Author (GRA)

N77-24283# Army Materials and Mechanics Research Center, Watertown, Mass.
SOVIET PROGRESS IN THERMOMECHANICAL TREATMENT OF METALS Final Report
Morris Azrin Nov. 1976 66 p refs
(AD-A034632; AMMRC-TR-76-36) Avail: NTIS HC A04/MF A01 CSCL 13/6

Soviet efforts in thermomechanical treatments (TMT) have continued unabated during the last decade. The predominant strengthening mechanisms have been firmly established, and procedures for simplifying the processing requirements have been developed. Substructural stabilization and hereditary treatments have received particular attention. Pilot plant and some production processing by TMT have been reported, though the type of end items involved has not substantially changed from earlier years. The typical applications involve processing of small volumes, while the TMT of large complex components is still not technically feasible. There are a number of small, simple components that have been successfully processed and evaluated in service. Surface hardening, particularly by roller burnishing, is one technological area where a wide range of specific hardware has been TMT processed. The background developed in all phases of TMT should enable Soviet designers to incorporate TMT into less publicized applications, as in military or aviation hardware, where the increased costs inevitably associated with TMT can be better tolerated. Author (GRA)

N77-24284# California State Dept. of Transportation, Sacramento. Transportation Lab.
FRACTURE TOUGHNESS OF STRUCTURAL GRADE BRIDGE STEELS, PART 1 Interim Report
R. D. Smith, C. B. Kendrick, and P. G. Jonas Apr. 1976 20 p refs Sponsored in part by Federal Highway Administration
(PB-263919/3; CA-DOT-TL-6708-1-76-34; Rept-636708; FHWA/RD-77-S0581) Avail: NTIS HC A02/MF A01 CSCL 11F

The brittle fracture resistance or toughness of a bridge steel was investigated. It tends to vary inversely with its grain size at service temperature. The service temperature grain size in turn tends to be proportional to the steel's austenitic grain size at the final rolling or normalizing temperature used to process it. The McQuaid-Ehn test, however, measures the austenitic grain size of a steel specimen at 1700 F. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-24285 British Library Lending Div., Boston Spa (England).
STUDY OF THE DRYING MECHANISM OF AQUEOUS ANTI-STICKING COATINGS
V. A. Chechulin, V. A. Gushchin, and G. V. Mel'chakov [1976] 9 p refs Transl. into ENGLISH from Izv. VUZ Chernaya Met. (Moscow), no. 6, 1976 p 123-126 In ENGLISH and RUSSIAN
(BLL-M-25482-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Equipment and a two stage process for studying the drying mechanism of aqueous anti-sticking coatings are described. During the first stage, evaporation of moisture proceeds from the surface and the drying speed is constant. Second stage is characterized by greater depth of the evaporation zone and a falling drying rate. The soluble binder moves together with moisture into the surface layer of the paint so that the inner layers are impoverished in binder after drying. This reduces the strength of adhesion of the paint of the base. Recommendations are given for increasing adhesion strength. Author

N77-24286*# Vanderbilt Univ., Nashville, Tenn. Dept. of Mechanical Engineering and Materials Science.
STUDY OF DIFFUSION COEFFICIENTS OF GLASSES UNDER ZERO-G Final Report, 1 Jun. 1974 - 30 Nov. 1976
D. L. Kinser 16 Mar. 1977 19 p refs
(Contract NAS8-30655)
(NASA-CR-150272) Avail: NTIS HC A02/MF A01 CSCL 11B

A diffusion experiment for glasses was formulated, such theoretical and earth bound results as were available were outlined, and the preliminary earth based experimental work in preparation for a weightless experiment was done. The fundamental premise of the work was that diffusion studies of the glass forming ion can be conducted in zero-g environments, and diffusion data obtained from these experiments are unique and valuable because of earth based experimental difficulties. Author

N77-24287*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CROSSLINKING AND DEGRADATION MECHANISMS IN MODEL SEALANT CANDIDATES Annual Report, 15 Sep. 1974 - 22 Apr. 1977
K. L. Paciorek, J. Kaufman, T. I. Ito, J. H. Nakahara, and R. H. Kratzer Apr. 1977 40 p refs
(Contract NAS2-7981)
(NASA-CR-151998; SN-8249-A2; AR-2) Avail: NTIS HC A03/MF A01 CSCL 11A

Model compounds were studied to determine which type of heterocyclic ring is most advantageous for curing sealants based on perfluoroalkylether chains. The synthesis of specifically substituted materials and the evaluation of their stabilities in air, inert atmosphere, water, and Jet-A fuel at 235 and 325 C were investigated. Three heterocyclic ring systems were considered, namely, triazine, 1,2,4- and 1,3,4-oxadiazoles. Evaluations are given for the 1,3,4-oxadiazole system and the perfluoroalkylether substituted-1,2,4-isomer. The effect of Jet-A and water on perfluoroalkyl-1,2,4-oxadiazole and perfluoroalkylether triazine is determined. Author

N77-24288*# IIT Research Inst., Chicago, Ill.
SPACE STABLE THERMAL CONTROL COATINGS Progress Report, 1 Nov. 1976 - 28 Feb. 1977
Y. Harada 30 Mar. 1977 26 p refs
(Contract NAS8-31906)
(NASA-CR-150276; IITRI-D6118-12) Avail: NTIS HC A03/MF A01 CSCL 11G

Efforts to develop an engineering paint were concentrated on inorganic silicate-bonded systems as opposed to the silicone coatings. The UV-vacuum stability of potassium silicate-Zn_2TiO_4 paints were shown to be quite good. Reflectance optimization of these systems is being studied by maximizing thickness and pigment to binder ratio. Author

N77-24289# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF THE TEMPERATURE AND MOISTURE ON THE CREEP OF POLYMER MATERIALS ONE-DIMENSIONAL TENSION UNDER NONSTATIONARY TEMPERATURE
R. D. Maksimov, E. A. Sokolov, and V. P. Mochalov 18 Oct. 1974 7 p refs Transl. into ENGLISH from Mekh. Polim. (Latvian S.S.R.), no. 6, 1975 p 976-982
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The polyester resin PN-3 was tested for creep under one dimensional tension in the linear domain of the stress-strain relation and different nonstationary temperature-moisture conditions. The experimental creep curves are compared with computations. The analysis is performed using the creep law and characteristics found in tests under stationary temperature-moisture conditions. The competency of the computation is confirmed by a comparison of the statistical estimates of the reproducibility of the test data and the accuracy of describing the results of the initial and checking tests. Author

N77-24290# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF THE TEMPERATURE AND MOISTURE ON THE CREEP OF POLYMER MATERIALS
R. D. Maksimov, V. P. Mochalov, and E. A. Sokolov [1976] 8 p refs Transl. into ENGLISH from Mekh. Polim. (USSR), no. 6, 1976 p 982-987
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The results of prolonged (from 2 to 6 yrs) control of tubular PN-3 specimens for creep under tension, and simultaneous tension and torsion under different temperature/moisture conditions are compared with a computation according to the data of short range (up to 5 yrs) tests in which acceleration of the creep process was achieved by raising the material temperature and humidity. The expected strains of the creep strength were computed by means of viscoelasticity relationships of a linearly hereditary body extended to the case of the influence of temperature and humidity under the assumption that the volume only changes elastically. Satisfactory correspondance between the results of the prediction and the prolonged checking tests is established. Author

N77-24291# Bendix Corp., Kansas City, Mo.
FRICTION AND WEAR STUDIES FOR BONDED THIN-FILM LUBRICANTS
D. P. Pope Aug. 1976 74 p
(Contract E(29-1)-613)
(BDX-613-1316) Avail: NTIS HC A04/MF A01

Light-load friction and wear characteristics were determined for ten commercially available, bonded dry-film lubricants. Of the six lubricants originally evaluated, Electrofilm 4396 was judged to be the best of the group. A later preliminary study of four other lubricants revealed that Electrofilm 77S may be better than 4396 for use in the small precision electromechanical devices. After tests on the original six lubricants found 4396 to be superior, a factorial design experiment used it to find the interaction between such friction-influencing variables as substrate finish and hardness, mating-part finish and hardness, and film polishing. Light-load-coefficient and wear-life data were compiled for Electrofilm 77S, 4396, and 4396S bonded dry-film lubricants. Static and dynamic friction performance were studied using the tribometer specially designed to test bonded films, and mean and standard deviations were calculated for comparison. ERA

N77-24292# Purdue Univ., Lafayette, Ind.
EFFECTS OF INTERNAL GAS PRESSURE ON THE MICROSTRUCTURE AND DIMENSIONAL STABILITY OF CERAMICS
R. A. Abbott, C. W. Tally (Babcock and Wilcox Co., Lynchburg, Va.), and A. A. Soloman 1976 10 p refs Presented at 6th Intern. Symp. - Ceram. Microstruct. 176, Berkeley, Calif., 24 Aug. 1976
(Contract E(11-1)-2713)
(COO-2713-1; Conf-760856-1) Avail: NTIS HC A02/MF A01

Preliminary results obtained on pellets of CoO indicate no significant effect of ambient pressure on sintering rates, but at pressures greater than 100 psig, anisotropic shrinkage was observed. After pore closure, reduction of shrinkage was observed. After pore closure, reduction of external pressure led to dedensification or swelling of the sintered body. ERA

N77-24293# California Univ., Livermore. Lawrence Livermore Lab.
FLEXIBLE EPOXIES FOR WET FILAMENT WINDING
J. A. Rinde, E. T. Mones, and H. A. Newey 10 Sep. 1976 21 p refs Presented at 32d Ann. Conf. of the Soc. of the Plastics Ind. Reinforced Plastics/Composites Inst., Washington, D. C., 8-11 Feb. 1977
(Contract W-7405-eng-48)
(UCRL-78278; Conf-770202-1) Avail: NTIS HC A02/MF A01

Epon 871, Epi-Rez 505, DER 732, DER 741, Araldite 508, Lekutherm X-80, and ATBN 1300X16 were chosen for study. Each of these materials was formulated into one or two resin systems for wet filament winding using Dow XD 7818 as the base resin, Dow XD 7114 as a reactive diluent, and Tonox 60-40 as the curing agent. Each system was formulated to have a viscosity of approximately 0.5 to 0.9 Pa's at 25 C. Each was gelled at 70 C for 3 h and cured at 130 C for 5 h. Gel times for 30-g samples at 25 C varied from 21.4 to 134.4 h. Percent water absorption varied from 2.3 to 4.9 percent, and the glass transition temperatures, as determined by thermal mechanical analysis, were in the range of 11 to 75 C. ERA

N77-24294# European Space Agency, Paris (France).
INVESTIGATIONS OF HOLLOW GLASS FIBERS FOR THE DEVELOPMENT OF REINFORCED PLASTICS
Guenter Niederstadt et al Apr. 1977 48 p refs Transl. into ENGLISH of 'Untersuch. von Hohlglasfasern fuer die Verbundwerkstoffentwicklungen', DFVLR, Brunswick Report DLR-FB-76-45, 16 Aug. 1976 Original report in GERMAN previously announced as N77-17251 Original German report available from DFVLR, Cologne DM 23
(ESA-TT-360; DLR-FB-76-45) Avail: NTIS HC A03/MF A01

Theoretical and experimental investigations were carried out to find a hollow fiber suitable for reinforcement purpose. An optimal wall-thickness/diameter ratio was determined theoretically according to the elasticity of the resin matrix. Fiber diameter, wall-thickness, dimensional inhomogeneities, and surface conditions such as voids and cracks were the subject of experimental investigations, including the evaluation of microscopic and electroscan photographs. Strength properties and their scatter were of interest. The ultimate fiber strength was found to be rather low compared with the strength of solid fibers.
Author (ESA)

N77-24295# National Swedish Road and Traffic Research Inst., Linkoeping.
INVESTIGATION OF BITUMINOUS DRUM MIXING PLANT 1975. QUALITY CONTROL OF PRODUCED MIXES
Erland Persson and Bengt Lilja 1976 64 p refs In SWEDISH; ENGLISH summary
(VTI-107) Avail: NTIS HC A04/MF A01

A detailed investigation was carried out regarding the quality of bituminous mixes produced in a Shearer drum mixing plant. The results showed that the drum mixing process with some limitations can produce a hot mix of good quality. Author (ESA)

N77-24296# Union Carbide Corp., Tarrytown, N.Y. Chemical and Plastics Lab.
D2-'META'-CARBORANE-SILOXANES. 3: PREPARATION AND PROPERTIES OF TRIFLUOROPROPYL MODIFIED POLYMERS
E. N. Peters, D. D. Stewart, J. J. Bohan, R. Moffitt, C. D. Beard, G. T. Kwiatkowski, and E. Hedaya 2 Feb. 1976 30 p refs
(Contract N00014-72-C-0277; NR Proj. 356-525)
(AD-A032462; CRL-T-838) Avail: NTIS HC A03/MF A01 CSCL 07/3

A series of linear, high molecular weight, trifluoropropyl substituted D2-m-carborane-siloxanes were prepared. These polymers were not as stable as conventional D2-m-carborane-siloxanes, however they exhibited greater thermal and oxidative stability than fluorosilicones. Indeed from TGA studies, the fluorosilicones start to lose weight 50 to 100 C below the onset of weight loss for the trifluoropropyl substituted carborane-siloxanes. Improved solvent resistance was obtained by the incorporation of trifluoropropyl groups onto the carborane-siloxane backbone. The tris-trifluoropropyl substituted polymer exhibited low swelling in hydrocarbon based solvents and fuels which was similar to results with fluorosilicones. GRA

N77-24297# Union Carbide Corp., Tarrytown, N.Y. Chemical and Plastics Lab.
D2-'META'-CARBORANE-SILOXANES. 4: SYNTHESIS OF LINEAR, HIGH MOLECULAR WEIGHT POLYMERS
E. Hedaya, J. H. Kawakami, G. T. Kwiatkowski, P. W. Kopf, D. W. McNeil, D. A. Owen, E. N. Peters, and R. W. Tulis 5 Mar. 1976 33 p refs
(Contract N00014-72-C-0277; NR Proj. 356-525)
(AD-A032463; CRL-T-839) Avail: NTIS HC A03/MF A01 CSCL 07/3

A new facile route to linear, high molecular weight D2-meta-decacarborane-siloxanes was developed based on the condensation reaction between bis-ureidosilanes and carborane disilanol. By using nmr to monitor the reaction stoichiometry, polymers with molecular weight greater than or equal to 250,000 have been prepared. Moreover, because of the mild reaction conditions, structural modifications of the polymer backbone have been readily achieved. These linear high molecular weight polymers overcome the fabrication difficulties encountered in previously prepared D2 polymers. GRA

N77-24298# Washington Univ., Seattle. Dept. of Mechanical Engineering.
DYNAMIC STRESS INTENSITY FACTOR OF HOMALITE-100 Interim Report
A. S. Kobayashi and S. Mall Dec. 1976 28 p refs
(Contract N00014-76-C-0060)
(AD-A034870; TR-27) Avail: NTIS HC A03/MF A01 CSCL 20/11

Dynamic stress intensity factors of Homalite-100 determined by T. Kobayashi and Dally are compared with those previously obtained by the authors where similarities in the two results for single-edged notch specimens of various configurations are noted. Dynamic stress intensity factors of Araldite B obtained by Kalthoff, Beinert, and Winkler and those of Homalite-100 obtained by the authors are then compared and again similarities in the two results and in particular the scatters in experimental data for wedge-loaded DCB specimens of different sizes are noted. All three teams of investigators used static near-field solution to compute the dynamic stress intensity factors from recorded dynamic isochromatics or dynamic caustics. Errors generated through this use of static near-field solutions as well as through the use of larger isochromatic lobes are thus discussed.
Author (GRA)

N77-24299# Horizons Research, Inc., Cleveland, Ohio.
ATTEMPTED PREPARATION OF POLYORGAONITRILES Technical Report, 1 Jan. - 31 Oct. 1976
Arthur H. Gerber Dec. 1976 41 p refs
(Contract N00014-75-C-0991)
(AD-A034143; TR-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

A variety of triazine monomers have been screened for polymerizability using metallic and nonmetallic catalysts at elevated temperatures. Cyanuric chloride, bromo-chloro-triazines, 2,4-dichloro-6-phenyl-triazine, are either inert or react slowly with or without chemical side reactions to give low molecular weight products. The novel monomers mono- and bis-(trifluoroethoxy)-chloro-triazines react degradatively to give low molecular weight products with extensive loss of volatile materials which are thought to be fluorine containing materials. Preparation of the potential monomer trifluoroethyl cyanate has led to simultaneous formation of nonvolatile product which may contain polymeric material.
Author (GRA)

N77-24300# Pennsylvania State Univ., University Park.
CONTROLLED CERAMIC-CERAMIC EUTECTIC MICROSTRUCTURES Final Report, 1969 - 1976
V. S. Stubican and R. C. Bradt 18 Nov. 1976 9 p refs
(Grants DA-ARO(D)-31-124-G1143;
DA-ARO(D)-31-124-71-G150)
(AD-A034235; ARO-8115.6-MC; ARO-13391.2-M2) Avail: NTIS HC A02/MF A01 CSCL 20/12

Preparation, microstructure, crystallography and mechanical properties of high melting oxide eutectics are described. It is

shown that the microstructure can be predicted from the volume fraction of the minor phase. Two basic criteria control the interface and crystallographic orientation: (1) minimization of the misfit between oxygen sublattices, (2) neutralization of ionic charge across the interfacial plane. The fracture strength is related to the colony size and decreases only slightly from room temperature to 1600 C. The fracture surface energy does not exhibit any dependence on fiber spacing. Knoop microhardness is greater than that of either the magnesia or spinel separately. The creep resistance of the grain microstructure is greater than that of the colony microstructure and $MgAl_2O_4$ single crystal. A void nucleation and growth mechanism may best describe the deformation process with eutectic ingots containing colonies or grains. Author (GRA)

N77-24301# Union Carbide Corp., Tarrytown, N.Y.
ORGANOSILANE POLYMERS Interim Report
J. P. Wesson and T. C. Williams Dec. 1976 39 p refs
(Contract N00014-75-C-1024)
(AD-A034808; TR-76-1) Avail: NTIS HC A03/MF A01 CSCL 07/3

Purified dialkyldichlorosilane monomers were reacted with alkali metals in organic solvent solutions to form linear diorganosilane homopolymers and copolymers. The organosilane polymers were characterized by spectrometric and thermal analysis. Polymer solubilities in organic solvents were determined. Formation of polymer charge transfer complexes were briefly examined. Author (GRA)

N77-24302# Naval Air Development Center, Warminster, Pa. Dept. of Air Vehicle Technology.
FLUORINATED HYDRAULIC FLUIDS. A STUDY OF THE DIRECT PARTIAL FLUORINATION OF SYNTHETIC FLUIDS FOR IMPROVING THEIR FIRE RESISTANCE PROPERTIES Final Report
Henry Lee and Alfeo A. Conte, Jr. 6 Dec. 1976 14 p ref
(AD-A034432; NADC-76361-30) Avail: NTIS HC A02/MF A01 CSCL 11/8

The direct partial fluorination of synthetic fluids, i.e., a synthetic hydrocarbon and an alkylated silicone was attempted in order to substantially improve their fire-resistance properties for use as aircraft hydraulic fluids. A maximum of 5 wt. percent fluorine could be incorporated into the synthetic hydrocarbon fluid with no observed improvement in fire-resistance properties. The incorporation of fluorine into an alkylated silicone fluid was not achievable. Author (GRA)

N77-24303# California State Dept. of Transportation, Sacramento. Transportation Lab.
COATINGS, SEALANTS AND PAVEMENT MARKERS
Donald R. Chatto, Robert W. Ford, Raymond Warness, and Bill J. Chapman Dec. 1976 48 p refs
(PB-263416/0; CA-DOT-TL-5135-3-76-46) Avail: NTIS HC A03/MF A01 CSCL 11C

Work done on rapid dry hot applied and fast dry cold applied traffic paint formulations, their improvement, and efforts to reduce raw materials costs is described. The development or modification of specifications for concrete curing compounds, zinc rich primers for structural steel, flame spray traffic lines, vinyl wash primer and rapid dry equipment enamel is discussed. Preliminary work on a series of laboratory tests for comparing effectiveness of five coating materials for protecting bridge deck concrete against damage by deicing salts is also included. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N77-24304 British Library Lending Div., Boston Spa (England).
EXPLOSIVE LIMITS OF PROPYLENE AND ACROLEIN
H. Inoue, H. Ito, and K. Takahashi [1977] 9 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Japan), v. 71, no. 5, 1968 p 615-618
(BLL-M-24833-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Apparatus for measuring explosive ranges is illustrated. Explosive limits of propylene-air and acrolein-air mixtures are given in tabular form along with explosive range diagrams. The effect of gas volume on explosive limits is also considered.
J.M.S.

N77-24305# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE THERMAL DECOMPOSITION OF AMMONIUM PERCHLORATE AND SOME MIXTURES ON ITS BASE
K. K. Andreev and Sun Tsyuan-Tsai [1976] 18 p refs Transl. into ENGLISH from the book "Teoriia Uzryvchatykh Veshchestv" Moscow, Vyshaia Shkola, 1967 p 99-119
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The thermal dissociation of ammonium perchlorate was investigated by a manometer method by using a glass manometer in the 160 deg-280 deg temperature range. It is shown that dissociation occurs in stages and includes the following: (1) an induction period, (2) acceleration of gas formation, (3) drop in velocity, and (4) a section of constant or weakly decreasing velocity. The greatest fraction of the dissociation is in the fourth stage. The acceleration and induction periods are brief and enclose a small pressure band. Mathematical regularities are established for the separate dissociation stages at low temperatures, a power law for the pressure rises in the acceleration section, and a velocity drop according to the law of the compressing sphere.
Author

N77-24306*# Southwest Research Inst., San Antonio, Tex.
MEASUREMENT OF BLAST WAVES FROM BURSTING PRESSUREIZED FRANGIBLE SPHERES Final Report
E. D. Esparza and W. E. Baker Washington NASA May 1977 55 p refs
(Grant NsG-3008)
(NASA-CR-2843; SwRI-02-4306) Avail: NTIS HC A04/MF A01 CSCL 19A

Small-scale experiments were conducted to obtain data on incident overpressure at various distances from bursting pressurized spheres. Complete time histories of blast overpressure generated by rupturing glass spheres under high internal pressure were obtained using eight side-on pressure transducers. A scaling law is presented, and its nondimensional parameters are used to compare peak overpressures, arrival times, impulses, and durations for different initial conditions and sizes of blast source. The nondimensional data are also compared, whenever possible, with results of theoretical calculations and compiled data for Pentolite high explosive. The scaled data are repeatable and show significant differences from blast waves generated by condensed high-explosives. Author

N77-24307# Illinois Inst. of Tech., Chicago.
BLAST PARAMETERS OF M26E1 PROPELLANT Final Report
J. J. Swatosh, Jr., J. R. Cook, and Paul Price Dec. 1976 108 p
(Contract DAAA21-74-C-0521)
(AD-A034072; IITRI-J6342-7; PA-TR-4901) Avail: NTIS HC A06/MF A01 CSCL 19/1

Experiments were performed with M26E1 propellant, multiperforated, 0.038 inch web size, in subscale and full-scale shipping drum, dryer, and blender configurations to determine the airblast pressure and positive impulse resulting from the detonating material. Variables considered included propellant weight, booster size, and configuration. Peak pressure and positive impulse were measured in the scaled distance range of approximately equal to 3 to 40 ft per lb to the one third power. TNT equivalency curves for both pressure and impulse were developed as a function of scaled range. Author (GRA)

N77-24308# Naval Weapons Center, China Lake, Calif.
ANALYSIS OF RDX AND HMX IN ADMIXTURE BY SINGLE-SWEEP POLAROGRAPHY
Gerald C. Whitnack Dec. 1976 24 p refs
(SF57572301)

(AD-A033293; NWC-TP-5898) Avail: NTIS HC A02/MF A01 CSCL 19/1

This report presents and describes a new polarographic analytical procedure that should prove useful in the direct analysis of RDX and HMX in admixture. The single-sweep technique is rapid and sensitive to about 50 parts-per-billion of either RDX or HMX alone or in admixture in effluent for natural water. The method can also be used to analyze for HMX as an impurity in manufactured RDX or for RDX that may be present in manufactured HMX. A determination can be made in 5 min on a 2-ml aliquot of water to within plus or minus 10% of the actual amount of explosive present. No separation or concentration of the explosives from the water sample is needed prior to the analysis in most cases. Author (GRA)

N77-24309# Aerojet Solid Propulsion Co., Sacramento, Calif.
FLEXIBLE CASE-GRAIN INTERACTION IN BALLISTIC WEAPON SYSTEMS. VOLUME 3: APPENDIXES Final Report, Apr. 1972 - Mar. 1976
Kenneth W. Bills, Jr., Samuel W. Jang, and Harold Leeming Oct. 1976 354 p refs
(Contract F04611-72-C-0055)
(AD-A032637; ASPC-1953-81-F-Vol-3; AFRPL-TR-76-57-Vol-3) Avail: NTIS HC A16/MF A01 CSCL 21/9

Seventeen appendices give detailed supplemental data in support of Volumes I and II. Author (GRA)

N77-24310# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
SOLID PROPELLANT ADMITTANCE MEASUREMENTS BY THE DRIVEN TUBE METHOD Interim Scientific Report, Jun. 1975 - Jul. 1976
B. T. Zinn, B. R. Daniel, W. A. Bell, and M. Salikuddin Aug. 1976 57 p refs
(Grant AF-AFOSR-2571-73)
(AD-A033308; AFOSR-76-1211TR) Avail: NTIS HC A04/MF A01 CSCL 21/9

The progress made during the third year of an investigation to measure the response of a burning solid propellant to oscillatory flow conditions is presented. In this study a modification of the impedance tube technique is used to measure the response over a wide range of frequencies. Improvements in the data reduction program are discussed. These include a more accurate method of computing the temperature distribution in the burner tube and a technique for determining the response from pressure amplitude measurements only. A high-pressure facility and minicomputer-based data acquisition system are also discussed in the report. Data taken at 300 psig indicate that the combustion process of the solid propellant periodically drives and damps acoustic oscillations under most of the test conditions encountered. Author (GRA)

N77-24311# Picatinny Arsenal, Dover, N. J.
EXPLOSIVE PERFORMANCE MODIFICATION BY COSOLIDIFICATION OF AMMONIUM NITRATE WITH FUELS
I. Akst and J. Hershkowitz Oct. 1976 61 p refs
(AD-A033552; PA-TR-4987) Avail: NTIS HC A04/MF A01 CSCL 19/1

Practical nonideal explosives with performance improved by modifying ideality are shown to be within reach. Materials which might be used are available in quantity at low cost, and processing techniques are ordinary. Performance enhancement was brought about by selecting fuels for an oxygen-rich nonideal explosive (ammonium nitrate) and improving reaction rates through more intimate reactant contact brought about by cosolidification. Explosives systems containing ammonium nitrate cosolidified with ethylenediamine dinitrate, or with nitroguanidine and guanidine nitrate, were studied and are described. In confined small-scale tests, they have better steel denting performance than Amatols, TNT, or Amatex 20. Detonation velocity ranges from 5 to 7 km/sec, depending on proportions and amount of RDX. Handling sensitivity, melting points, hygroscopicity, and compatibility with TNT and RDX appear to be manageable. Long-term stability, casting, scale-up and other engineering factors have not been assessed. Author (GRA)

N77-24312# Picatinny Arsenal, Dover, N. J.
EFFECT OF LONG TERM LOW-LEVEL GAMMA RADIATION ON THERMAL SENSITIVITY OF RDX/HMX MIXTURES Final Report
Louis Avrami and Henry J. Jackson Nov. 1976 28 p refs
(AD-A032959; PA-TR-4964) Avail: NTIS HC A03/MF A01 CSCL 19/1

HMX, RDX, HMX/RDX mixtures and Comp B were subjected to low level long-term Co60 gamma radiation (225 R/hr for 90, 120, and 150 days). Differential thermal analysis, thermogravimetric analysis, weight loss determination, vacuum stability, infrared spectrometry, impact sensitivity and explosion temperature tests were used. It was found that the thermal stability and sensitivity of these explosives were not adversely affected by the exposures. Author (GRA)

N77-24313# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
OXIDATION KINETICS OF HYDROCARBON FUELS Annual Report, 1 Jul. 1975 - 30 Jun. 1976
Irvin Glassman Sep. 1976 46 p refs
(Grant AF-AFOSR-2604-74; AF Proj. 9750)
(AD-A032743; AMS-1309; AFOSR-76-1194TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report discusses interim results on the elucidation of high temperature oxidation kinetics of hydrocarbon fuels through experimental studies in a turbulent flow reactor. The report details current results particularly on ethane oxidation. Also discussed are results of an exploratory study of low pressure metal/oxidizer flame systems as a source of chemical laser action. Author (GRA)

N77-24314# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
FUELS AND LUBRICANTS Final Report on Test Operations Procedure
2 Jul. 1976 34 p refs
(AD-A032842; TOP-2-2-701) Avail: NTIS HC A03/MF A01 CSCL 21/4

A method is prescribed for evaluating military fuel and lubricant compatibility with Army vehicles and a method for sampling and spectrometric analysis of lubricants for symptoms of metal wear or contamination. Equipment and facilities and basic test requirements are described. Tests for octane and cetane requirements; engine, transmission, and vehicle compatibility; cold starting; and hydraulic, gear oil, and grease systems are described. A chart is included of typical fuels and lubricants for Army vehicles and equipment. Author (GRA)

N77-24315# Stanford Research Inst., Menlo Park, Calif.
STUDIES OF HOMOGENEOUS AND HETEROGENEOUS HYDRAZINE DECOMPOSITION FOR MONOPROPELLANT PROPULSION SYSTEMS Annual Report, 1 Jun. 1975 - 31 May 1976
D. Golden, K. E. Lewis, R. T. Rewick, S. E. Stein, and H. Wise Sep. 1976 51 p refs
(Contract F44620-73-C-0069; AF Proj. 6813; SRI Proj. PYU-2716)
(AD-A033647; AFOSR-76-1412TR) Avail: NTIS HC A04/MF A01 CSCL 07/4

Heterogeneous kinetic studies of hydrazine decomposition at atmospheric and subatmospheric pressures and infrared absorption measurements on alumina-supported iridium catalysts point to a reaction intermediate as the surface contaminant responsible for catalyst deactivation. The temperature region around 450 K has been found to be most detrimental to catalyst life under laboratory test conditions for hydrazine decomposition. GRA

N77-24316# Battelle Columbus Labs., Ohio.
COMBUSTION ADDITIVES FOR POLLUTION CONTROL: A STATE-OF-THE-ART REVIEW Final Task Report, May 1972 - Dec. 1975
H. H. Krause, L. J. Hillenbrand, Albert E. Weller, and David W. Locklin Jan. 1977 106 p refs
(Contract EPA-68-02-0262)
(PB-264068/8; EPA-600/2-77-008a) Avail: NTIS HC A06/MF A01 CSCL 21D

A state-of-the-art review is presented of the potential of combustion-type fuel additives in reducing air pollutant emissions from oil and coal firing. A review of the relation of combustion mechanisms to additive action in controlling emissions; and a review of experimental investigations of combustion-type fuel additives are reported. The evidence for control by fuel additives of visible smoke and carbon particulate is relatively strong; that for control of polycyclic organic matter is somewhat weaker. GRA

N77-24317# Battelle Columbus Labs., Ohio.
EXPERIMENTAL EVALUATION OF FUEL OIL ADDITIVES FOR REDUCING EMISSIONS AND INCREASING EFFICIENCY OF BOILERS Final Task Report, May 1972 - Dec. 1975
Robert D. Giammar, Albert E. Weller, David W. Locklin, and Horatio H. Krause Jan. 1977 124 p refs Sponsored in part by FEA
(Contract EPA-68-02-0262)
(PB-264065/4; EPA-600/2-77-008b) Avail: NTIS HC A06/MF A01 CSCL 21D

Most additive evaluation runs were made during continuous firing, constant load operation of the boiler. Additives, both proprietary and pure compounds, containing alkaline-earth and transition metals in concentrations between 20 and 50 ppm were effective in reducing carbon particulate emissions by as much as 100 percent when firing residual oil. They also were effective in reducing emissions of smoke and polycyclic organic matter. No additive was found to be effective in reducing either NOx or SOx. Certain of these additives used in residual oil permitted an increase in overall boiler efficiency by reducing stack gas loss, without increasing particulate emissions. GRA

N77-24318# Institute of Gas Technology, Chicago, Ill.
ASSESSMENT APPLICATION FOR DIRECT COAL COMBUSTION Final Report
Mark E. Fejer, Peter A. Ketels, Marie-Therese Kouo, Jack D. Nesbitt, and Donald R. Shoffstall Oct. 1976 268 p refs
(Contract NSF C-924; IGT Proj. 8970)
(PB-263651/2; NSF/PRA-7505072) Avail: NTIS HC A12/MF A01 CSCL 21D

The feasibility of converting 9 processes within 24 SIC energy-intensive industries to pulverized coal with minimum cost and environmental impacts was analyzed. Selection of the candidate processes was based on its use of direct process heat, contribution to the total industry energy consumption pattern, and level of emissions and emission control. Factors assessed include: ability to maintain its thermal requirements, product quality, furnace requirements, and pollution level of particulate matters, sulfur oxides, and nitrogen oxides with coal firing. Results indicated that pulverized coal can fulfill the requirements of cement and lime calcining, iron ore beneficiation, blast furnace, open hearth, glass melting for container glass production, and brick firing which can be immediately converted with minimum environmental impact. GRA

N77-24319# Federal Power Commission, Washington, D. C. Office of Economics.
INCREMENTAL PRICING OF SUPPLEMENTAL GAS
Aug. 1976 54 p refs
(PB-263689/2) Avail: NTIS HC A04/MF A01 CSCL 21D

Efficiency, equity, and administrative aspects of incremental and rolled-in pricing are covered. The feasibility of implementing incremental pricing at both the pipeline and burner tip levels is studied. Implications of combining a retail resale market with an incremental pricing scheme are discussed. GRA

N77-24320# Federal Power Commission, Washington, D. C. Bureau of Natural Gas.
THE GAS SUPPLIES OF INTERSTATE NATURAL GAS PIPELINE COMPANIES, 1975
28 Jan. 1977 125 p
(PB-263598/5) Avail: NTIS HC A06/MF A01 CSCL 21D

A statistical summary of the year-end 1975 total reserves and deliverability of the interstate pipeline companies and pertinent comparisons is provided. GRA

N77-24321# Federal Energy Administration, Washington, D. C. Office of Energy Information and Analysis.
PETROLEUM MARKET SHARES - A REPORT ON SALES OF REFINED PETROLEUM PRODUCTS, 1972 THROUGH 1975: AVIATION GASOLINE, JET FUELS, MIDDLE DISTILLATE FUEL OILS, RESIDUAL FUEL OIL, MOTOR GASOLINE
30 Apr. 1976 183 p refs
(PB-262726/3; FEA/B-76/308) Avail: NTIS HC A01/MF A01 CSCL 21D

Market share information for refiners and independent marketers of aviation gasoline, jet fuels, middle distillate fuel oil, residual fuel oil, and motor gasoline is presented. In general, information is presented for the period January 1972 through December 1975. The gasoline market share information is directed primarily towards changes in 1975. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-24322# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE MOTION OF A STIFF RECTANGULAR BODY SUBJECTED TO A PLANE WAVE, IN AN ELASTIC MEDIUM
M. A. Rylko [1977] 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverd. Tela (USSR), no. 1, 1977, p 158-164
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The plane dynamic problems for an unbounded elastic medium with a stiff homogeneous rectangular inclusion are considered. It is assumed that there is no friction between the medium and the inclusion. The motion of a body subjected to an incident plane wave at an arbitrary angle is investigated. It is shown that for times less than the time for a longitudinal wave to traverse one of the sides of the rectangle, the body motion is described by ordinary differential equation system with variable coefficients. Author

N77-24323# Naval Ship Research and Development Center, Bethesda, Md.
EFFECTS OF BOUNDARY-LAYER DEVELOPMENT ON CAVITATION NOISE AND INCEPTION ON A HYDROFOIL
William K. Blake, Melvin J. Wolpert, III, Frank E. Geib, Jr., and Henry T. Wang Dec. 1976 72 p refs
(ZR0110801)
(AD-A034586; DTNSRDC-76-0051) Avail: NTIS HC A04/MF A01 CSCL 13/10

Measurements are described of noise from cavitating flow over hydrofoils. The experiments were performed in a variable pressure water tunnel that was acoustically calibrated so that sound power levels could be deduced from the sound measurements. It was partially reverberant in the frequency range of interest. Cavitation was generated on the low-pressure side of a hydrofoil in the presence of a separated laminar boundary layer on the one hand and of a fully turbulent attached boundary layer on the other. The turbulent boundary layer was formed downstream of a trip, which was positioned near the leading edge. High-speed photographs show patterns of cavitation obtained in each case. Cavitation was also generated on the high-pressure side at negative angles of attack. The noise is shown to depend on the type of cavitation produced; for each type, dependence on speed and cavitation index has been determined. Author (GRA)

N77-24324# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
LOW FROUDE NUMBER HYDRODYNAMIC PERFORMANCE OF A FLAT PLATE HYDROFOIL
Michael B. Wilson and Terry R. Kelley Dec. 1976 115 p refs
(AD-A034535; SPD-743-01) Avail: NTIS HC A06/MF A01 CSCL 20/4

Results of towing tank experiments are presented for lift,

drag, moment, and center of pressure of an aspect ratio 4, rectangular planform, 5.21 percent thick, flat plate hydrofoil attached to a large strut and pod and operated beneath the free surface of water. The nominal range of the chord Froude number was 0.5 to 3.5 with corresponding chord Reynolds numbers of 740,000-5,200,000. Tests included foil submergence depths ranging from 0.25 to 3.5 chord lengths, and foil angles of attack varying from 0 -8 deg. These data fill an important gap in our experimental knowledge of near-surface, low speed hydrofoil performance. Experiments indicate that there are significant changes in lift and drag for operation at shallow and moderate submergences in the low chord Froude number range, especially around 0.75 to 1.5. Prediction of residual drag coefficients for an 18-foot-chord hydrofoil operating at constant lift shows that the wavemaking drag is significant and that the trend of increase in residual drag at froude numbers ranging from 3.5 down to 1.75 appears to be roughly parallel to the trend of induced drag alone. However, the magnitudes of residual drag coefficients are rather large, and there are indications that interference wave drag, due to the presence of a strut and a pod, is an important feature of the low speed drag variation. GRA

N77-24325# Office of Naval Research, London (England).
THERMOMETRY AND TEMPERATURE SCALES: THE INSTITUTE OF PHYSICS MEETING
T. A. Kitchens, Jr. 25 Aug. 1976 8 p Meeting held in London, Jun. 1976
(AD-A033324; ONRL-C-22-76) Avail: NTIS HC A02/MF A01 CSCL 20/13

A review of a meeting of the Institute of Physics in London on Thermometry is presented. Discussions included mK adjustments in the near 4 K range, plantenium resistance thermometry up to 273 K, and fixed point superconducting thermometry. GRA

N77-24326# Ball Bros. Research Corp., Boulder, Colo.
DEVELOPMENT OF A HYDROPHOBIC SUBSTANCE TO MITIGATE PAVEMENT ICE ADHESION
G. H. Ahlborn and H. C. Poehlmann, Jr. Dec. 1976 218 p refs
(Contract EPA-68-03-0359)
(PB-263653/8; EPA-600/2-76-242) Avail: NTIS HC A10/MF A01 CSCL 13B

The factors involved in evaluating this concept are the following: economics; safety; environmental impact; coating effectiveness; potential pavement damage. As a result of this program, two coating formulations are identified as showing considerable promise as semi-permanent, hydrophobic, road coatings with reduced ice adhesion. They are: a modified (no pigment) Federal Specification TT-P-115D traffic paint containing a room-temperature-curing silicone rubber (Dow Corning DC732) as a release agent; and a silicone resin waterproofing compound with the same silicone rubber as above. One major achievement in this program was the discovery of a method for stabilizing the highly reactive silicone rubber in a fluid solution for spraying. GRA

N77-24327# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
IS HYDROGEN SAFE
J. Hord Oct. 1976 42 p refs
(PB-262551/5; NBS-TN-690) Avail: NTIS HC A03/MF A01 CSCL 21D

Physical and chemical property data for hydrogen, methane, and gasoline are compiled and used to provide a basis for comparing the various safety features of the three fuels. Each fuel is examined to evaluate its fire hazard, fire damage, explosive hazard and explosive damage characteristics. The threat of fuel-air explosions in confined spaces is greatest for hydrogen. Gasoline is believed to be the easiest and perhaps the safest fuel to store because of its lower volatility and narrower flammable and detonable limits. It is concluded that all three fuels can be safely stored and used; however, the level of safety risk for each fuel will vary from one application to another. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N77-24328* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SAMPLING VIDEO COMPRESSION SYSTEM Patent
Yutaka Matsumoto and Henry Lum, inventors (to NASA) Issued 24 May 1977 7 p Filed 27 May 1976 Supersedes N76-24436 (14 - 15, p 1916)
(NASA-Case-ARC-10984-1; US-Patent-4,025,950; US-Patent-Appl-SN-690815; US-Patent-Class-358-133; US-Patent-Class-358-138) Avail: US Patent Office CSCL 17B

A system for transmitting video signal of compressed bandwidth is described. The transmitting station is provided with circuitry for dividing a picture to be transmitted into a plurality of blocks containing a checkerboard pattern of picture elements. Video signals along corresponding diagonal rows of picture elements in the respective blocks are regularly sampled. A transmitter responsive to the output of the sampling circuitry is included for transmitting the sampled video signals of one frame at a reduced bandwidth over a communication channel. The receiving station is provided with a frame memory for temporarily storing transmitted video signals of one frame at the original high bandwidth frequency. Official Gazette of the U.S. Patent Office

N77-24329 British Library Lending Div., Boston Spa (England).
TIME PROBABILITY OF THE PICTURE QUALITY
H. Dobesch and H. Sulanke 29 Nov. 1976 8 p refs Transl. into ENGLISH from Tech. Mitteilungen des RFZ (W. Germany), v. 20, no. 1, 1976 p 12-13
(BLL-PO-3386-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

The results of RFZ studies were applied to subjective picture quality and statistics for picture channel parameters of TV transmission installations. The probability distribution of the picture quality was calculated in terms of the observer's opinion. The influence of individual picture channel parameters on the quality was studied. Author

N77-24330 British Library Lending Div., Boston Spa (England).
STUDY AND REALIZATION OF A SEMICONDUCTOR MEMORY MODULE FOR EXPERIMENTAL TV SIGNAL BANDWIDTH REDUCTION
S. Brofferio and G. Raffa 29 Nov. 1976 10 p refs Transl. into ENGLISH from Alta Frequenza (Italy), v. 45, no. 3, Mar. 1976 p 181-184
(BLL-PO-3404-(9022.81)) Avail: Brisith Library Lending Div., Boston Spa, Engl.

A system for processing television signals in digital form with a view to reducing the bandwidth required for transmission was designed. The proposed method reduces the quantity of information to be transmitted by using a field memory capable of storing a complete monochrome picture in digital form. The memory required and the structure proposed is discussed. The components available and the selection criteria adopted are then reviewed. The structure of the module is described and problems posed by the testing of the modules are examined. Author

N77-24331* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
UNBALANCED QUADRIPHASE DEMODULATOR Patent
Herbert S. Koybayashi and Sydney P. Bradfield, III, inventors (to NASA) Issued 31 May 1977 6 p Filed 3 Jun. 1976 Supersedes N76-26367 (14 - 17, p 2178)
(NASA-Case-MSC-14840-1; US-Patent-4,027,265; US-Patent-Appl-SN-692414; US-Patent-Class-329-122; US-Patent-Class-325-346; US-Patent-Class-329-104; US-Patent-Class-178-88) Avail: US Patent Office CSCL 17B

A new and improved apparatus and method are described for demodulation of quaternary phase shift keyed (QPSK) data,

particularly unbalanced QPSK. Phase adjustment of the output of a phase locked loop local oscillator is performed to reduce sensitivity to amplitude variations internal to the demodulator.
Official Gazette of the U.S. Patent Office

N77-24332*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
TRANSMITTER EXPERIMENT PACKAGE FOR THE COMMUNICATIONS TECHNOLOGY SATELLITE
B. Farber, D. S. Goldin, B. Marcus, and P. Mock [1977] 200 p refs
(Contract NAS3-15839)
(NASA-CR-135035) Avail: NTIS HC A09/MF A01 CSCL 17B

The operating requirements, system design characteristics, high voltage packaging considerations, nonstandard components development, and test results for the transmitter experiment package (TEP) are described. The TEP is used for broadcasting power transmission from the Communications Technology Satellite. The TEP consists of a 12 GHz, 200-watt output stage tube (OST), a high voltage processing system that converts the unregulated spacecraft solar array power to the regulated voltages required for OST operation, and a variable conductance heat pipe system that is used to cool the OST body. Author

N77-24333*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MICROWAVE PERFORMANCE CHARACTERIZATION OF LARGE SPACE ANTENNAS
D. A. Bathker, ed. 15 May 1977 79 p refs
(Contract NAS7-100)
(NASA-CR-153206; JPL-Publ-77-21) Avail: NTIS HC A05/MF A01 CSCL 20N

Performance capabilities of large microwave space antenna configurations with apertures generally from 100 wavelengths upwards are discussed. Types of antennas considered include: phased arrays, lenses, reflectors, and hybrid combinations of phased arrays with reflectors or lenses. The performance characteristics of these broad classes of antennas are examined and compared in terms of applications. Author

N77-24334*# Ohio State Univ., Columbus. ElectroScience Lab.
THE OSU SELF-PHASED ARRAY FOR PROPAGATION MEASUREMENTS USING THE 11.7 GHz CTS BEACON
D. M. Theobold and D. B. Hodge Nov. 1976 26 p refs
(Contract NAS5-22575)
(NASA-CR-152519; ESL-4299-1) Avail: NTIS HC A03/MF A01 CSCL 20N

A self phased array was developed for propagation measurements on an earth-space path. The 11.7 GHz CTS beacon was used as the signal source. The self phased array was used to measure angle of arrival as well as attenuation and scintillation statistics. The performance of the array is described, and sample data are presented. The tracking capability of the self phased array was also studied. This technique permits fully electronic, nonmechanical satellite tracking, thus simplifying unmanned operation and eliminating severe weather tracking constraints.
Author

N77-24335*# Battelle Pacific Northwest Labs., Richland, Wash.
ATS-6 mm-WAVE PROPAGATION EXPERIMENT Final Report, 7 May 1974 - 6 Sep. 1976
Carl C. Davis and Philip A. Ekstrom 1 Sep. 1976 21 p ref
(Contract NAS5-20504)
(NASA-CR-152522) Avail: NTIS HC A02/MF A01 CSCL 20N

Attenuation on a Space-to-Earth path was measured at 20 GHz for a ground terminal at approximately 1 km elevation in an arid (16 cm annual precipitation) region of eastern Washington state. Precipitation intensity and radiometric sky temperature at 20 GHz were also measured. Attenuation greater than 1 dB was observed only in the presence of wet snow on antenna surfaces. Ten thousand (10,000) hours of radiometric sky temperature data recorded over an 18-month period indicated atmospheric attenuation of 5 to 7 dB during two instances of rain intensity of approximately 1 inch per hour. Author

N77-24336# Institute for Telecommunication Sciences, Boulder, Colo.
RADAR MICROWAVE LINK PILOT SYSTEM UPGRADE AND EVALUATION Final Report
D. Smith and F. G. Kimmett Dec. 1976 66 p
(Contract DOT-FA74WA-1522)
(AD-A037198; FAA-RD-76-184) Avail: NTIS HC A04/MF A01 CSCL 17/2

Methods of upgrading the existing Radar Microwave Link systems were developed and tested in the laboratory. Replacement of existing Klystron and other tube-type components with solid-state units can be expected to provide additional system fade margin and greater system equipment reliability . Author

N77-24337# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EVALUATION OF A CORRELATION-SENSITIVE AUTOMATIC CLUTTER ELIMINATOR Final Report, Nov. 1975 - Apr. 1976
William C. Swanseen Mar. 1977 20 p refs
(FAA Proj. 122-111-320)
(AD-A037125; FAA-NA-76-40; FAA-RD-76-220) Avail: NTIS HC A02/MF A01 CSCL 17/9

A computer simulation conducted by MITRE indicated that an automatic clutter eliminator (ACE) using correlation information within the clutter sum register of the common digitizer (CD) could be used to improve target detection and reduce false targets due to radar weather clutter. A real time hardware device was fabricated to perform the correlation estimation and lead edge generation according to the MITRE requirement. A series of tests was conducted to compile data comparing digitizer performance using the correlation sensitive ACE/CD with performance from an unmodified CD. Test results indicate reductions in false targets up to 30 percent are possible with no loss of real target detection. Author

N77-24338*# National Aeronautics and Space Administration. Pasadena Office, Calif.
REFLEX FEED SYSTEM FOR DUAL FREQUENCY ANTENNA Patent Application
Robert H. Hartop, inventor (to NASA) (JPL) Filed 24 Mar. 1977 8 p
(Contract NAS7-100)
(NASA-Case-NPO-14022-1; US-Patent-Appl-SN-780728) Avail: NTIS HC A02/MF A01 CSCL 17B

A reflex feed system for a dual frequency antenna is described which may be, for example, one which transmits and receives both S and X band signals. The system uses, in place of the dichroic plate normally employed for directing X band radiation away from the X band horn, a flange about the opening of the X band horn. NASA

N77-24339*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COLLAPSIBLE CORRUGATED HORN ANTENNA Patent Application
Donald E. Barthlome, inventor (to NASA) Filed 20 May 1977 10 p
(NASA-Case-LAR-11745-1; US-Patent-Appl-SN-799025) Avail: NTIS HC A02/MF A01 CSCL 17B

A corrugated horn antenna that is readily collapsible while not in use is described. A plurality of different sized annular metal rings are arranged in a sequence such that each ring is larger than the one that precedes it in the sequence. Thin flexible electrically conductive members attach successive metal rings together physically and connect them together electrically. Each flexible conductive member is attached to make electrical contact between the outside surface of a metal ring and the inside surface of an adjacent metal ring in the sequence. NASA

N77-24340*# National Aeronautics and Space Administration. Pasadena Office, Calif.
PHASE CONJUGATION METHOD AND APPARATUS FOR AN ACTIVE RETRODIRECTIVE ANTENNA ARRAY Patent Application
Robert C. Tausworthe (JPL) and Ralph C. Chernoff, inventors (to NASA) (JPL) Filed 16 Mar. 1977 36 p
(Contract NAS7-100)

(NASA-Case-NPO-13641-1; US-Patent-Appl-SN-777983) Avail: NTIS HC A03/MF A01 CSCL 17B

An active retrodirective antenna array is described in which a reference array element is used to generate a phase reference which is replicated at succeeding elements of the array. Each element of the array is associated with a phase regeneration circuit and the phase conjugation circuitry of an adjacent element. In one implementation, the phase reference circuit operates on the input signal at the reference element, a voltage controlled oscillator output signal, and the input pilot signal at the next array element received from a transmission line. In another implementation, particularly suited for large arrays in space, two different input pilot frequencies are employed. Their difference is the phase reference of the system, and a local oscillator is used in obtaining this difference, which is in the IF range. In both implementations, appropriate mixing and filtering is performed to achieve phase conjugation and phase reference replication. NASA

N77-24341*# National Aeronautics and Space Administration. Pasadena Office, Calif.

DIGITAL DEMODULATOR-CORRELATOR Patent Application

James W. Layland (JPL), Warren L. Martin (JPL), Arthur I. Zygielbaum (JPL), Richard M. Goldstein (JPL), and William P. Hubbard, inventors (to NASA) (JPL) Filed 29 Mar. 1977 35 p

(Contract NAS7-100)

(NASA-Case-NPO-13982-1; US-Patent-Appl-SN-782464) Avail: NTIS HC A03/MF A01 CSCL 17B

An apparatus was designed for the demodulation and correlation of a code modulated signal with respect to a reference signal in ranging systems for tracking spacecraft or aircraft, or surveying. In conjunction with simultaneous operation of three tracking stations, enough accuracy may be achieved to implement an aircraft collision avoidance system. The demodulator correlator may also be used for telemetry in a system where a transponder at a remote station delays transmission of a return code for a period proportional to an analog signal from a transducer. More than one transducer may be accommodated by using frequency division multiplexing techniques. NASA

N77-24342*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

HYBRID RECEIVER STUDY

Marvin S. Stone, Peter L. McAdam, and Oliver W. Saunders Apr. 1977 130 p

(Contract NAS2-9367)

(NASA-CR-151984) Avail: NTIS HC A07/MF A01 CSCL 17B

The results are presented of a 4 month study to design a hybrid analog/digital receiver for outer planet mission probe communication links. The scope of this study includes functional design of the receiver; comparisons between analog and digital processing; hardware tradeoffs for key components including frequency generators, A/D converters, and digital processors; development and simulation of the processing algorithms for acquisition, tracking, and demodulation; and detailed design of the receiver in order to determine its size, weight, power, reliability, and radiation hardness. In addition, an evaluation was made of the receiver's capabilities to perform accurate measurement of signal strength and frequency for radio science missions. Author

N77-24343*# Systems Control, Inc., Palo Alto, Calif.

A TECHNIQUE FOR MEASURING ROTOCRAFT DYNAMIC STABILITY IN THE 40 BY 80 FOOT WIND TUNNEL Interim Report, 16 Jan. 1976 - 15 Jan. 1977

Narendra K. Gupta and Jeff G. Bohn Feb. 1977 135 p refs

(Contract NAS2-8799)

(NASA-CR-151955) Avail: NTIS HC A07/MF A01 CSCL 17B

An on-line technique is described for the measurement of tilt rotor aircraft dynamic stability in the Ames 40- by 80-Foot Wind Tunnel. The technique is based on advanced system identification methodology and uses the instrumental variables approach. It is particulary applicable to real time estimation problems with limited amounts of noise-contaminated data. Several simulations are used to evaluate the algorithm. Estimated natural frequencies and damping ratios are compared with simulation values. The algorithm is also applied to wind tunnel data in an off-line mode. The results are used to develop preliminary guidelines for effective use of the algorithm. Author

N77-24344# Physics Lab. RVO-TNO, The Hague (Netherlands).

INTRODUCTION TO THE DETECTION THEORY

W. C. DeVries Jul. 1976 26 p refs In DUTCH; ENGLISH summary

(PhL-1976-28; TDCK-67957) Avail: NTIS HC A03/MF A01

The principles of the theory of detection of signals against a background of interfering signals (noise) with stochastic properties, are given. Several cases are distinguished, in which the nature of the signal and of the noise are known to a greater or lesser extent: thermal noise in resistors, thicker noise of electronic tubes, atmospheric noise. Author (ESA)

N77-24345# Physics Lab. RVO-TNO, The Hague (Netherlands).

EFFECT OF SHIP MOTION ON SONAR DETECTION PERFORMANCE

J. G. Schothorst Jul. 1976 28 p ref

(PhL-1976-33; TDCK-68110) Avail: NTIS HC A03/MF A01

Analytical expressions are given for the two main effects of ship motion on the detection performance of a sonar: attenuation and distortion of sonar echoes. Regarding attenuation for a ship with an unstabilized transducer, graphs are presented in which the minimum, maximum, and mean loss are plotted as a function of the amplitude of the ship movement. For the distortion, formulas were derived for the maximum frequency spread and optimum length of a tone pulse. On the basis of actual ship motion data, an estimate is made of the optimum pulse length for the worst case situation. Author (ESA)

N77-24346# Physics Lab. RVO-TNO, The Hague (Netherlands).

THE MULTIPATH RADAR CROSS SECTION (RCS) MEASURING FACILITY AT NOOTDORP

H. Sittrop Nov. 1976 18 p ref

(PhL-1976-44; TDCK-68625) Avail: NTIS HC A02/MF A01

Methods of measurement and calibration are described for an outdoor multipath radar cross section measuring facility. The operating frequency bands are X- and Ku-band respectively at 9284 MHz and 16500 MHz. The two radars cannot be operated simultaneously. Author (ESA)

N77-24347# Physics Lab. RVO-TNO, The Hague (Netherlands).

GENERAL PROPERTIES OF ALPHA BETA, AND ALPHA BETA GAMMA TRACKING FILTERS

A. M. Navarro Jan. 1977 53 p refs

(PhL-1977-02; TDCK-68708) Avail: NTIS HC A04/MF A01

The major properties and important design equations of first and second order tracking filters, known as alpha-beta and alpha-beta-gamma filters, are described. Some realized versions of these filters are discussed together with their typical properties, emphasizing alpha-beta filters, since these are applied to radar tracking. ESA

N77-24348# Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.

CALCULATION OF ERROR PROBABILITY FOR SYSTEMS WITH CIRCULAR WAVEGUIDES [CALCOLO DELLA PROBABILITA D'ERRORE PER SISTEMI IN GUIDA D'ONDA CIRCOLARE]

Luciano Buti (Centro Studi e Lab. Telecomun.) 29 Apr. 1976 33 p refs In ITALIAN

Avail: NTIS HC A03/MF A01

The error probability due to intersymbolic and interchannel interface and Gaussian noise was evaluated for a digital communication system using circular waveguides. A calculation, based on the method of Gaussian quadratures, was made for the Italian system, which uses PSK quadriphase modulation and coherent demodulation. The choice of this method was suggested essentially by the simplicity with which it can be adapted to a digital computer processing. ESA

N77-24349# Fondazione Ugo Bordoni, Rome (Italy).

EFFECT OF THE RAIN PRECIPITATION INTENSITY PROFILE ON ATTENUATION AND DEPOLARIZATION AT FREQUENCIES ABOVE 10 GHz [INFLUENZA DEL PROFILO

DELL'INTENSITA DI PRECIPITAZIONE PIOVOSA SULLA ATTENUAZIONE E SULLA DEPOLARIZZAZIONE A FREQUENZE SUPERIORI A 10 GHz]
Dario Maggiori 10 May 1976 16 p refs In ITALIAN
Avail: NTIS HC A02/MF A01

The effects of rain on propagation were investigated theoretically. The difference of attenuation and discrimination between horizontally and vertically polarized EM waves was calculated for uniform precipitation along a radio link of 9.5 km. The effect of the precipitation intensity profile on the difference in attenuation and on the discrimination was studied. Results are presented for 17.8 GHz and 30 GHz. ESA

N77-24350# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
MICROWAVE IMAGERY OF ROTATING OBJECTS WITH NARROW BAND SIGNALS USING THE SYNTHETIC APERTURE PRINCIPLE [MIKROWELLENABBILDUNG ROTIERENDER OBJEKTE MIT SCHMALBANDSIGNALEN NACH DEM SYNTHETIK-APERTUR-PRINZIP]
H. Gniss and K. Magura May 1976 85 p refs In GERMAN; ENGLISH summary
(Contract T/RF-32/RF-320/41058)
(Rept-1-76) Avail: NTIS HC A05/MF A01

The intrinsic rotational motion of a distant object is used to generate a circular synthetic aperture radar. An image field distribution in the plane of rotation can then be reconstructed by evaluation of amplitude and phase of the measured scattered field. Image field distributions are discussed for several simple and more complex metallic objects, which have been reconstructed from the measured scattered fields at 36 GHz. In particular the influences of the aspect angle and the angle of aperture on the image quality were investigated. In some cases polarization effects depending on the object's structure are shown. Sometimes fictive scattering centers may appear resulting from multiple scattering between various object parts. This effect, which renders a localization of the real scattering centers more difficult, was studied in the case of an object consisting of two circular cylinders.
Author (ESA)

N77-24351# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
INFLUENCE OF THE DEGREE OF THINNING OF STATISTICALLY THINNED ANTENNA ARRAYS ON THE MUTUAL COUPLING EFFECTS [EINFLUSS DES VERDUENNUNGSGRADES STATISTISCH VERDUENNTER ANTENNENGRUPPEN AUF DIE VERKOPPLUNGSEFFEKTE]
E. Ludwig and G. Ries Jun. 1976 67 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Rept-2-76) Avail: NTIS HC A04/MF A01

Effects of mutual coupling in statistically highly thinned arrays of wave-guide radiators are dealt with. The numerical results show the influence of the degree of thinning on the reflection coefficients and the reflected power, as well as on the element patterns and the array gain. The integral array effects may be derived by the statistics of the effects for discrete array elements. Results from the complicated exact calculations are compared with approximative formulas which show the influence of thinning very clearly. From these and from pattern measurements the approximations proved to be valid for highly thinned arrays containing maximally 20% of the elements in filled arrays. For these high degrees of thinning mutual coupling effects are evident in the reflection coefficients and patterns of discrete array elements, but negligible in the reflection coefficient and the gain of the whole array. Author (ESA)

N77-24352# Institute for Telecommunication Sciences, Boulder, Colo.
ELECTROMAGNETIC INTERFERENCE EFFECTS ON MOTOR VEHICLE ELECTRONIC CONTROL AND SAFETY DEVICES. VOLUME 2: MEASUREMENTS, ANALYSIS AND TESTING Final Report, 1 Mar. 1975 - 1 Jul. 1976
R. H. Espeland, D. H. Layton, B. D. Warner, and L. R. Teters Nov. 1976 142 p refs
(Contract DOT-HS-5-01097)
(PB-262823/8; DOT-HS-802108) Avail: NTIS HC A07/MF A01 CSCL 13F

The results of a test series to evaluate the electrical environment of a motor vehicle during normal operating conditions and a summary of power supply variations and electrical signal transient characteristics are presented. A computerized coupling analysis program was used to determine the effects of body shielding, aperture size, and cable lengths on signal coupling in the 100 to 200 MHz band between a simulated mobile radio emission and a modeled air-cushion restraint system cable as it might be used in a motor vehicle. A series of susceptibility tests were performed on an electronic speed control system and an anti-skid control module to determine functional upset levels of injected signals at critical circuit ports on these devices. GRA

N77-24353# Institute for Telecommunication Sciences, Boulder, Colo.
ELECTROMAGNETIC INTERFERENCE EFFECTS ON MOTOR VEHICLE ELECTRONIC CONTROL AND SAFETY DEVICES. VOLUME 3: AUTOMOTIVE EMC GUIDELINES Final Report, 1 Mar. 1975 - 1 Jul. 1976
R. H. Espeland and E. L. Morrison, Jr. Nov. 1976 92 p refs
(Contract DOT-HS-5-02109; Contract DOT-HS-5-01097)
(PB-262824/6; DOT-HS-802109) Avail: NTIS HC A05/MF A01 CSCL 13F

A set of basic guidelines to promote EMC in the use of electronic control and safety devices in automobiles is presented. The applications and technological developments concerned with current automotive electronics are discussed. The research conducted by the automotive industry to explore the feasibility of a central processor or control system and potential problem areas are reviewed. Automotive electrical environment including a summary of source coupled waveforms and guidelines for design, installation and testing of electronic control and safety devices in automobiles are among the topics discussed. GRA

N77-24354# Stanford Research Inst., Menlo Park, Calif.
NEW ELECTRONIC-TRANSITION LASER SYSTEMS. PART 1: ELECTRON PUMPED SYSTEMS. PART 2: CHEMICALLY PUMPED SYSTEMS Final Technical Report, 8 Feb. 1974 - 15 Dec. 1976
H. H. Nakano, R. M. Hill, D. C. Lorents, D. L. Huestis, and D. J. Eckstrom Dec. 1976 114 p refs
(Contract DAAH01-74-C-0524; ARPA Order 1180; SRI Proj. PYU-3190)
(AD-A033997; SRI-MP-76-99-Pt-1; SRI-MP-76-99-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 20/5

This report consists of two parts. Part I describes the program to develop a kinetic model for the energy flow in electron-beam pumped rare gas-halide lasers. The experimental program involves observations of fluorescence from argon/krypton/fluorine mixtures pumped by a short pulse electron beam. In addition to the emissions at 193 nm (ArF) and 248 nm (KrF) the authors observe significant broad band emissions near 290 nm and 400 nm which they assign to Ar2F and Kr2F. The important reactions that form ArF and KrF are also discussed in this report. Part II summarizes the status of electronic-transition chemical laser development. There has not yet been a demonstration of gain in a visible chemical laser system, and it appears unlikely that practical lasers of this type will be developed in the near future. Substantial progress has been made toward understanding the kinetics of highly exothermic reactions, but a complete knowledge of any one system is still to be achieved. GRA

N77-24355# AEL Service Corp., Farmingdale, N. J.
ELECTROMAGNETIC RADIATION SYSTEM (EMRS) FOR SUSCEPTIBILITY TESTING Quarterly Report, 2 Feb. - 30 Apr. 1976
Edwin S. Iskra Dec. 1976 50 p refs
(Contract DAAB07-76-C-0332)
(AD-A034795; AELSC-TR-23-2; ECOM-76-0332-2; QR-2) Avail: NTIS HC A03/MF A01 CSCL 20/3

The function of the Electromagnetic Radiation System (EMRS) is to generate electromagnetic energy so as to produce a constant field strength that can be automatically scanned as a function of frequency. The design objective is to cover the frequency range of 30 hertz to 40 gigahertz with field strength intensities up to 200 volts per meter. A stripline approach is described and proposed for use as the field generating device for the

lower frequencies. The use of defocused parabolas are proposed for use at the higher frequencies. Author (GRA)

N77-24356# California Univ., San Diego.
THE RELATION BETWEEN IONOSPHERIC PROFILES AND ELF PROPAGATION IN THE EARTH-IONOSPHERE TRANSMISSION LINE Final Report, 1 Apr. 1975 - 30 Nov. 1976
Henry G. Booker 30 Nov. 1976 154 p refs
(Contract N00014-75-C-0959)
(AD-A034129) Avail: NTIS HC A08/MF A01 CSCL 04/1

An approximate method, based on a wave-solution, is used to sketch the dependence of ELF propagation in the earth-ionosphere transmission line on time of day, latitude, season of the year, epoch in the sunspot cycle, and occurrence of sudden ionospheric disturbances and polar cap absorption events. As the frequency descends through the ELF band, penetration of the D region occurs in succession for the O and X waves, leading to reflection from the E region at the Schumann resonant frequency. Under quiet day-time ionospheric conditions the penetration frequency-band is around 20-60 hz in middle and high latitudes, but around 75-150 hz near the equator. At a frequency low enough to be reflected primarily from the E region under quiet ionospheric conditions, an increase in D region ionization that is just sufficient to transfer primary reflection from the E region to the D region results in an increase in the rate of attenuation. On the other hand, once reflection is firmly established at the lower level, further increase of ionization in the D region causes a reduction in the rate of attenuation. Similar effects are expected to occur at night in association with a sub-E region ledge of ionization. Small variations in the ionization profile of such a ledge are the likely cause of night-time fluctuations of transmission at 45 and 75 hz. GRA

N77-24357# Honeywell, Inc., St. Petersburg, Fla. Aerospace Div.
ATEC DIGITAL ADAPTATION STUDY. VOLUME 3: SUMMARY AND RECOMMENDATIONS Final Technical Report, 27 Jun. 1975 - 29 Feb. 1976
T. R. Armstrong, A. K. Blough, Jr., T. J. Campbell, D. T. Doyle, E. N. Dulaney, and R. A. Ziesner Griffiss AFB, N. Y. RADC Oct. 1976 112 p
(Contract F30602-75-C-0282)
(AD-A033716; HONEYWELL-476-13656-Vol-3; RADC-TR-302-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 17/2

The automated technical control (ATEC) Digital Adaptation Study sought to answer the questions: (1) What should be monitored for PA/FI/TA of the FKV system; (2) What measurements, data collection, and analysis should a monitor system perform, (3) Are the ATEC system and equipments applicable in satisfying the measurement and analysis requirements, either unmodified or with minor adaptations, and (4) Can an ATEC/FKV demonstration be performed: The study addressed each of these questions in turn, and the answer is that the ATEC system and equipments, augmented by minor hardware and software adaptations, can satisfy all the PA/FI/TA monitoring system requirements for the FKV digital transmission system. An ATEC monitoring system for the entire FKV system is presented, and operational characteristics dealing with all aspects of the monitoring system are presented. In addition, an ATEC/FKV demonstration configuration is presented which would enable the validation of the ATEC digital transmission system monitoring capability through field testing and data collection on a link within the FKV system. Author (GRA)

N77-24358# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ENVIRONMENT AND RADAR OPERATION SIMULATOR Quarterly Report, 1 Oct. - 31 Dec. 1975
S. N. Cole and A. R. Clayton Mar. 1976 36 p refs
(Contract DAAB07-74-C-0272; DA Proj. 1S7-62703-DH-93)
(AD-A034676; ECOM-74-0272-6; QR-6) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report summarizes activities during the sixth quarter of a program sponsored by the U.S. Army Electronics Command (ECOM), directed toward the design of an Environment and Radar Operation Simulator (EROS). The analysis of clutter-simulation digital filters has been directed toward determining the effect of filter parameters on the filter's output statistics. The feedback multipliers control the shape of the spectrum, and formulas are given relating the multiplier values to spectral characteristics. Parameters of the pseudo-random number generator and other filter parameters control clutter amplitude distribution. An algorithm is provided for computing these parameters from given amplitude-distribution constraints. Digital hardware design has included the clutter filters, clutter azimuth weighting, the target processor, and several frequently used modules. Real-time software design has been directed toward the executive control program, which coordinates the computer's target, clutter, and display activities. Author (GRA)

N77-24359# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADAPTIVE NULLING WITH MULTIPLE-BEAM ANTENNAS
Joseph T. Mayhan 30 Sep. 1976 114 p refs
(Contract F19628-76-C-0002)
(AD-A034652; ESD-TR-76-304; TN-1976-18) Avail: NTIS HC A06/MF A01 CSCL 22/2

This technical note discusses some of the more prominent features of an adaptive nulling algorithm when used in conjunction with a multiple-beam antenna operating over the earth field of view at synchronous altitude. A brief discussion of some of the basic properties of the multiple-beam antenna configuration used in the study is presented, following which some of the characteristics of the conventional LMS power minimization algorithm, such as the Applebaum-Howells type, as they apply to the multiple-beam antenna, are developed. The relationship of the adapted radiation pattern to radiation pattern synthesis techniques is discussed. Next the time required for the algorithm to adapt to the steady state solution is considered. For the LMS algorithm, the dynamic range of interference power levels to be nulled sets the dynamic range of adaption times required by the adaptive algorithm. This spread in adaption times is related to the spread in the eigenvalues of the interfering-source correlation matrix defined at the receive ports. Techniques for compressing this eigenvalue spread, and hence increasing the dynamic range of the algorithm, are determined. GRA

N77-24360# Naval Research Lab., Washington, D. C.
TRACKING FILTERS FOR MULTIPLE-PLATFORM RADAR INTEGRATION Final Report
G. V. Trunk and J. D. Wilson 14 Dec. 1976 20 p refs
(NRL Proj. R02-97)
(AD-A034608; NRL-8087) Avail: NTIS HC A02/MF A01 CSCL 17/9

The Kalman filter is the optimum tracking filter regardless of whether or not radar detections are made from single or multiple platforms. The performance of the Kalman filter has been simulated for various radar-target geometries. An error criterion involving the Mahalanobis distance function is used to detect target maneuvers, and an interactive scheme based on this criterion is used to increase the error covariance matrix to its proper value. Attempts to replace the Kalman filter with a simple filter with comparable performance have not been productive. The basic reason behind this difficulty is that accurate position and velocity estimates (obtainable by triangulation from different platforms) require the processing of position and velocity covariance matrices. Since both matrices must be saved and updated, a simple filter does not seem possible. GRA

N77-24361# Technology Service Corp., Santa Monica, Calif.
DIGITAL SIMULATION OF HIGH RESOLUTION RADAR IMAGERY Final Technical Report, Jun. 1975 - Jun. 1976
Jeffrey W. Bell Griffiss AFB, N. Y. RADC Oct. 1976 70 p refs
(Contract F30602-75-C-0303)
(AD-A033714; TSC-PD-B486-2; RADC-TR-76-290) Avail: NTIS HC A04/MF A01 CSCL 14/5

This study was an exploratory development program with the purpose of establishing the fundamental capability of simulating SAR imagery of future systems for use in exercising change detection processors. To this end the objectives of the program were twofold: (1) to develop algorithms and techniques for simulating high resolution imagery for future SAR systems using aerial photography, topographical maps, and SAR imagery from present systems as source data, and (2) to generate a set

of simulated imagery under a variety of conditions to demonstrate the methods. Author (GRA)

N77-24362# Rome Air Development Center, Griffiss AFB, N.Y.
DAASM PROJECT-HIGH LATITUDE AIRCRAFT HF PROPAGATION EXPERIMENT, PART 2
Gary S. Sales and John I. Videberg Jul. 1976 25 p refs (AF Proj. 5631)
(AD-A034024; RADC-TR-76-235-Pt-2) Avail: NTIS HC A02/MF A01 CSCL 17/9

The purpose of the DAASM project was to investigate the effects of the auroral ionosphere on long-range propagation of HF radio signals. The HF radio signals transmitted from an aircraft and received at Goose Bay, Labrador, were analyzed to determine the degree to which the Doppler frequency and arrival angle were perturbed by passage through the auroral ionosphere. As part of this analysis the propagation modes for each data sample were determined, using vertical and oblique incidence sounders. The experiment detail and the data, analyzed in this report in more detail, were described in a prior DAASM report (AFCRL-TR- 75-0290/ERP No. 516). E-mode propagation dominated the data samples and may be considered good propagation conditions. The median value for the absolute angular deviation was 2 deg from the true bearing of the aircraft, well within the uncertainty of the aircraft position. The maximum deviation was 9 deg. The median value for the angular spreading was 4 deg and it varied between 2 and 6 deg. F-mode signals showed a median angular spreading of 5 deg. Finally, the Doppler frequency spread varied between 0.3 and 0.8 Hz with a median of 0.33 Hz. In general, the auroral effects on E-mode propagation were small, though considerably larger than would be expected at midlatitude. Author (GRA)

N77-24363# IIT Research Inst., Chicago, Ill.
EMP PREFERRED TEST PROCEDURES (SELECTED ELECTRONIC PARTS), REVISION
J. E. Bridges, W. C. Emberson, V. P. Nanda, W. C. Wells, and L. C. Peach Sep. 1976 332 p refs Revised
(Contract DNA001-72-C-0089; DNA001-73-C-0149)
(AD-A034791; IITRI-E6230-Rev; DNA-3286H-Rev) Avail: NTIS HC A15/MF A01 CSCL 18/6

EMP preferred test procedures are provided to evaluate and characterize the performance of a number of electrical devices. Topics covered are experiment design, documentation, typical induced EMP transients, and the specific test procedures to evaluate the EMP behavior for each type of electronic component. GRA

N77-24364# Naval Electronics Lab. Center, San Diego, Calif.
OPSATCOM FIELD MEASUREMENTS, VOLUME 1 Research and Development Report, Jun. - Aug. 1975
R. G. Driscoll, J. N. Martin, and S. Karp 1 Jun. 1976 622 p refs
(AD-A034806; NELC/TD-490-Vol-1) Avail: NTIS HC A99/MF A01 CSCL 17/2

The ability of light to penetrate the sea to operationally useful depths, the ease with which optical energy can be generated and modulated, and the ability to direct this energy into narrow beams utilizing small antennas (optical systems) illustrate the theoretical feasibility of optical communication links in the sea. For example, when the proportionate sea path is limited to lengths of hundreds of feet (or meters), optical communication links between an earth orbiting satellite and submerged terminals appear possible. Before such optical communication links become practical, phenomena reported in the literature must be quantified to reliably predict system performance. This is necessary for systematic design and evaluation of terminals. For example, optical beam spreading, attenuation, air/sea interface effects, and background radiant intensities must all be documented to be used for component development. With these objectives in mind, an experiment designed to measure the propagation characteristics of light in the ocean was conducted in the vicinity of Santa Catalina Island, California, between June and August 1975. GRA

N77-24365# Pacific Fleet, FPO San Francisco 96610. Third Fleet.
REFRACTIVE EFFECTS GUIDEBOOK (REG)
22 Sep. 1976 66 p Supersedes TACMEMO-280-2-75
(AD-A034073; TACMEMO-280-1-76) Avail: NTIS HC A04/MF A01 CSCL 17/9

The Refractive Effects Guidebook (REG) is designed to provide the Fleet with an initial capability to tactically exploit large scale atmospheric refractive conditions. Using routine weather information available to Fleet units, the REG presents guidelines for planning the employment of radar, sensor and communications systems according to existing and predicted refractive conditions that frequently cause unusual performance (termed anomalous propagation). GRA

N77-24366# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ELECTROMAGNETIC SCATTERING BY CONCENTRIC FINITE CYLINDERS M.S. Thesis
David Grayson Ardis Dec. 1976 70 p refs
(AD-A034276; GE/EE/76-13) Avail: NTIS HC A04/MF A01 CSCL 20/3

This thesis deals with electromagnetic scattering from two concentric finite length cylinders. The scattering bodies are assumed to be perfect electric conductors and the incident field is assumed to be a plane wave whose magnetic field is transverse to the longitudinal axis of the scatterers. Electromagnetic field equations are derived in terms of vector potentials. Integral equations are developed for the surface currents induced on the cylinders. A numerical solution is formulated in terms of the method of moments for the unknown surface currents and the components of the scattered electric field. Results are presented for scatterers of different dimensions. Comparisons are made between scattering from a finite hollow cylinder and scattering from two concentric finite cylinders. Author (GRA)

N77-24367# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
DEVELOPMENT OF A COMPUTER MODEL FOR SCATTERING OF ELECTROMAGNETIC WAVES BY A TURBULENT WAKE Final Technical Report, 1 Jul. 1975 - 30 Jun. 1976
Paul E. Bisbing Oct. 1976 119 p
(Contract F19628-76-C-0011; AF Proj. 2153)
(AD-A032662; RADC-TR-76-297) Avail: NTIS HC A06/MF A01 CSCL 20/14

This report describes a theoretical model for the radar scattering by a turbulent, re-entry induced ionized wake. The equations used, their derivations, and the FORTRAN listing of the computer code are given and explained in detail. The output from a sample run of the program is given and explained. Comparisons are made between the results of this model and published data from laboratory experiments on microwave scattering from turbulent plasma. The results of some parametric calculations are given also. This theoretical model assumes that the Electrical properties of the wake plasma are known in terms of certain statistical and spatial distributions. The technique used by the model is a distorted wave born approximation in which the propagation in the background medium is calculated rigorously for a layered cylinder of mean wake plasma. The model provides predictions of the backscattering amplitude and the first and second moments of the Doppler spectrum, both at each input wake axial station and as a function of apparent axial station in the backscattered pulse. Direct and cross polarized scattering are included for both linear and circular polarization radars. Author (GRA)

N77-24368# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
APPLICATIONS OF MATRIX METHODS RADIATION AND SCATTERING SYSTEMS Final Report, 1 Jan. 1973 - 30 Jun. 1976
Roger F. Harrington Sep. 1976 19 p refs
(Contract F19628-73-C-0047)
(AD-A032686; RADC-TR-76-306) Avail: NTIS HC A02/MF A01 CSCL 20/14

The objective of this research project was to investigate applications of matrix methods to radiation and scattering systems. Four major topics were investigated, namely: (a) antenna pattern synthesis, (b) wire antennas over imperfect ground, (c) radiation and scattering from large bodies, and (d) electromagnetic transmission through apertures. All technical reports issued on

project work are listed and abstracts of each are given. Published papers and oral papers related to project work are also listed. Based on the results of this project, recommendations for further research work are given. Author (GRA)

N77-24369# Ohio State Univ., Columbus. Electroscience Lab.
A MODIFIED FM SIGNAL FOR USE WITH AN ADAPTIVE ARRAY Quarterly Report, 1 Apr. - 30 Jun. 1976
I. K. Lao and R. T. Compton, Jr. Sep. 1976 14 p refs
(Contract N00019-76-C-0195)
(AD-A034322; ESL-4326-2) Avail: NTIS HC A02/MF A01 CSCL 09/5

The report discusses the use of adaptive arrays with FM signals. The objective of this work is to develop an approach for integrating an adaptive array into a conventional FM communication system. A method of modifying an FM signal to allow the array to distinguish between it and interference is currently under study. GRA

N77-24370# Rome Air Development Center, Griffiss AFB, N.Y.
EFFECT OF LOCATION ON THE EFFECTIVENESS OF SPATIAL FILTERS
Ronald L. Fante Sep. 1976 16 p refs
(AF Proj. 2153)
(AD-A034025; RADC-TR-76-296) Avail: NTIS HC A02/MF A01 CSCL 20/14

We have demonstrated that the radiation pattern modification caused by the placement of either a multiple-dielectric-layer or a wire-grade spatial filter between an antenna and observer is independent of where the filter is placed, provided the filter is not located too close to the antenna to cause a significant change in antenna current distribution. Author (GRA)

N77-24371# Gulton Industries, Inc., High Point, N. C.
DESIGN MODIFICATION OF FEMCO MODEL 702909 WIRELESS GROUND MONITOR Final Report
Leonard F. Vitt Jul. 1976 31 p
(Contract DI-BM-H0166034)
(PB-262858/4; BM-OFR-15-77) Avail: NTIS HC A03/MF A01 CSCL 08I

Femco Model 702909 Wireless Ground Monitor was modified as follows: (1) a voltage regulator was added to prevent false trips withline voltage variations; (2) a ground wire trap was designed to eliminate problems with parallel paths and provide spark suppression; (3) a three-phase filter was designed to permit complete test of installed systems and (4) the design was modified to insure trip with an open ground wire in the event of a failure of any one semiconductor component. GRA

N77-24372# Signatron, Inc., Lexington, Mass.
A SIMULATOR TO PRODUCE NARROWBAND MULTIPATH EFFECTS ON L-BAND AIRCRAFT-TO-SATELLITE SIGNALS Final Report, Mar. 1972 - Jun. 1973
Edward H. Getchell and Paul F. Mahoney Dec. 1976 36 p ref
(Contract DOT-TSC-372)
(PB-263624/9; DOT-TSC-OST-76-44) Avail: NTIS HC A03/MF A01 CSCL 17B

The aircraft-to-satellite communications channel was studied as well as instrumentation to accurately simulate the effects of the multipath, Doppler, and additive noise effects of such channels. The simulator provides capability for test and evaluation of communications and navigation equipment under controlled and repeatable conditions without the need for extensive, costly, time-consuming and nonrepeatable field experiments. The basic approach to channel simulation is to split up the signal into several parts, delay each path differently then multiply the delayed signals by a set of complex noise waveforms and sum the results. GRA

N77-24373# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
ELECTROMAGNETIC REMOTE SENSING OF INHOMOGENEOUS MEDIA
Wolfgang A. Bereuter (Colo. Univ., Boulder) and David C. Chang (Colo. Univ., Boulder) Jan. 1977 21 p refs
(PB-263124/0; NBSIR-76-851) Avail: NTIS HC A02/MF A01 CSCL 20N

The electromagnetic response of inhomogeneous dielectrics, i.e. media whose permittivity is a function of depth is reviewed. The resulting boundary value problem is solved for a large number of permittivity functions which can model almost any medium of interest. Since those permittivity profiles are characterized by only a few parameters, they are particularly useful for the inverse problem; i.e., the retrieval of profiles from the measured electromagnetic response. It is shown how the non-uniformity of the permittivity changes the response and how the change is related to the profile characteristics. GRA

N77-24374# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
ANOMALOUS PROPAGATION AND INTERFERENCE FIELDS
H. T. Dougherty and B. A. Hart Dec. 1976 71 p refs
(PB-262477/3; OTR-76-107) Avail: NTIS HC A04/MF A01 CSCL 20N

The enhanced fields that are encountered in the presence of the stratified atmosphere, the ducting conditions associated with supercritical refractivity gradients both near the surface and aloft are considered. As a basis for estimating the likelihood of occurrence of these supportive conditions, the available information is surveyed. It is suggested that the access to computers and the availability of historical radiosonde data be exploited and the pertinent characteristics of elevated layers and their associated ducts be mapped on a worldwide basis to meet the interference prediction requirements of regulatory agencies. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N77-24375* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
OPEN LOOP DIGITAL FREQUENCY MULTIPLIER Patent
Robert Clark Moore, inventor (to NASA) (APL, Johns Hopkins Univ., Laurel, Md.) Issued 24 May 1977 4 p Filed 10 Nov. 1975 Supersedes N76-13377 (14 - 04, p 0443) Sponsored by NASA
(NASA-Case-MSC-12709-1; US-Patent-4,025,866; US-Patent-Appl-SN-630583; US-Patent-Class-328-38; US-Patent-Class-307-225R; US-Patent-Class-328-39; US-Patent-Class-328-4-8; US-Patent-Class-328-63) Avail: US Patent Office CSCL 09A

An open loop digital frequency multiplier is described which has a multiplied output synchronized to low frequency clock pulse. The system includes a multistage digital counter which provides a pulse output as a function of an integer divisor. The integer divisor and the timing or counting cycle of the counter are interrelated to the frequency of a clock input. The counting cycle is controlled by a one shot multivibrator which, in turn, is driven by a reference frequency input.
Official Gazette of the U.S. Patent Office

N77-24376 British Library Lending Div., Boston Spa (England).
PRODUCTION OF PRINTED CIRCUITS: ON THE PROBLEM OF THE ETCH DRESSING IN THE SEMIADDITIVE TECHNIQUE AND THE QUESTION OF PRE-ETCHED BASE MATERIAL
H. Fasbender Dec. 1976 8 p refs Transl. into ENGLISH from Galvanotechnik (West Germany), v. 67, no. 4, 1976 p 297-300
(BLL-RTS-10325) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The problem of etch dressing is addressed and the questions as to the specific problems of the pre-etched material. The material, the surface of which was already prepared by the laminate

manufacturer for copper deposition, and hence was introduced directly by the conductor-board producer into the wet-chemical line as copper backed base material, was considered. Author

N77-24377 British Library Lending Div., Boston Spa (England).
ON FACTORS INFLUENCING THE USEFUL LIFE OF FILAMENT LAMPS IN NON-STATIONARY CONDITIONS
L. I. Limanov Jan. 1977 4 p Transl. into ENGLISH from Svetekhnika (USSR), no. 9, 1975 8 p
(BLL-RTS-10481) Avail: British Library Lending Div., Boston Spa, Engl.: £3.00; 3 BLL overseas, 3 European or 12 UK BLL photocopy coupons

A possible mechanism of failure for filament lamps which have a defect in filament diameter is proposed. The local compression of helical filamentary bodies (pitch defect) leads to lamp failure, especially in nonstationary conditions, because in the defective area the starting temperature exceeds the steady mean temperature of the filamentary body. A method is given for analysis of the thermal state of the defective zone under nonstationary lamp operating conditions. Author

N77-24378 British Library Lending Div., Boston Spa (England).
THE FIELD OF A TURBOGENERATOR WITH NON-MAGNETIC MATERIALS IN THE MAGNETIC CIRCUIT
J. Sergl Dec. 1976 28 p refs Transl. into ENGLISH from Arch. fuer Elektrotech. (West Berlin), v. 56, no. 6, 1974 p 320-330
(BLL-RTS-10299) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

Magnetic field calculations are presented for a turbogenerator with superconducting excitation windings. Because the resistance associated with the end field lines is of the same order of magnitude as that for the field lines interlinked with the straight section, the calculations take the end windings into account. The conductor currents in the end windings have components in both the shaft axis and the peripheral directions (axial and circumferential current sheets, respectively), therefore the problem is three dimensional. The effects of tappings and terminals are ignored. It is assumed that the end windings at both ends of the machine are identical and the conductors are distributed continuously. D.M.L.

N77-24379 British Library Lending Div., Boston Spa (England).
MODERN TIME MEASUREMENT WITH RELAYS
D. Klein 20 Dec. 1976 11 p Transl. into ENGLISH from Elektron.-Ind. (West Ger.), v. 9, 1975 p 170-173
(BLL-SMRE-Trans-6591-(8313.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The most important phases of movement are first defined. Measurement procedures, sources of error, and important parameters to be considered are then discussed. Finally, a method of investigation is described which enables one, without the use of a high speed camera, to visually follow every detail of mechanical patterns of movement. Author

N77-24380 British Library Lending Div., Boston Spa (England).
MAGNETIC PERMEABILITY AS A FACTOR IN THE DESIGN OF INDUCTORS WITH FERROMAGNETIC CHARGE MATERIAL FOR INDUCTION HEATING EQUIPMENT
F. Reinke, H. Geisel, and L. Springob 29 Nov. 1976 75 p refs Transl. into ENGLISH from Fortschr.-Ber. der VDI Zeitschriften (W. Germany), ser. 9, no. 11, Jun. 1975
(BLL-OA-Trans-1563-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

Permeability was experimentally determined, giving accurate results when employed in the known formula. Equivalent permeability values were determined as calculation values from a large number of systematically conducted measurements. Using these calculation values it is possible to calculate the active component and reactive component of the resistance of the charge material, when the principal dimensions of the charge heated and of the heating inductor, resulting from the heating requirement, and also the power density are known. The residual resistances of the equivalent circuit of the inductor and the technical data of the induction heating installation are also calculated using the methods of calculation given. Author

N77-24381 British Library Lending Div., Boston Spa (England).
THE TURBO-GENERATOR WITH SUPERCONDUCTING FIELD WINDING IN TRANSIENT OPERATION
H. Fuerisch Dec. 1976 14 p refs Transl. into ENGLISH from Arch. fuer Elektrotech. (W. Berlin), v. 57, no. 6, 1976 p 291-296
(BLL-RTS-10351) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

For a model of a turbogenerator with superconducting winding which is suitable for mathematical treatment, the specific current loads produced by the windings are given for arbitrary variation of the currents with time. A two-dimensional field analysis yields the magnetic fundamental harmonic fluxes linked with the windings and forms the voltage differential equations. Along with the form of the electromagnetically developed torque and the equations of motion describing the behavior of the mechanical union, the system equations of the generator are obtained. Author

N77-24382*# Toledo Univ., Ohio.
DIAGONAL DOMINANCE FOR THE MULTIVARIABLE NYQUIST ARRAY USING FUNCTION MINIMIZATION Final Report, 1 Jun. 1975 - 31 Dec. 1976
Gary G. Leininger May 1977 109 p refs
(Grant NsG-3063)
(NASA-CR-153058; TR-7701) Avail: NTIS HC A06/MF A01 CSCL 09C

A new technique for the design of multivariable control systems using the multivariable Nyquist array method was developed. A conjugate direction function minimization algorithm is utilized to achieve a diagonal dominant condition over the extended frequency range of the control system. The minimization is performed on the ratio of the moduli of the off-diagonal terms to the moduli of the diagonal terms of either the inverse or direct open loop transfer function matrix. Several new feedback design concepts were also developed, including: (1) dominance control parameters for each control loop; (2) compensator normalization to evaluate open loop conditions for alternative design configurations; and (3) an interaction index to determine the degree and type of system interaction when all feedback loops are closed simultaneously. This new design capability was implemented on an IBM 360/75 in a batch mode but can be easily adapted to an interactive computer facility. The method was applied to the Pratt and Whitney F100 turbofan engine. Author

N77-24383*# Technology and Economics, Inc., Cambridge, Mass.
FLAT CONDUCTOR CABLE COMMERCIALIZATION PROJECT Final Report
Peter Hogarth and Ethel Wadsworth 29 Apr. 1977 39 p ref
(Contract NAS8-31955)
(NASA-CR-150274) Avail: NTIS HC A03/MF A01 CSCL 09C

An undercarpet flat conductor cable and a baseboard flat conductor cable system were studied for commercialization. The undercarpet system is designed for use in office and commercial buildings. It employs a flat power cable, protected by a grounded metal shield, that terminates in receptacles mounted on the floor. It is designed to interface with a flat conductor cable telephone system. The baseboard system consists of a flat power cable mounted in a plastic raceway; both the raceway and the receptacles are mounted on the surface of the baseboard. It is designed primarily for use in residential buildings, particularly for renovation and concrete and masonry construction. D.M.L.

N77-24384*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSFORMER DESIGN TRADEOFFS
W. T. McLyman 15 Mar. 1977 92 p refs Revised
(Contract NAS7-100)
(NASA-CR-153204; JPL-TM-33-767-Rev-1) Avail: NTIS HC A05/MF A01 CSCL 09C

In space, power system transformer components are frequently the heaviest and bulkiest items in the power conversion circuit. They also have a significant effect upon the overall performance and efficiency of the system. Accordingly, the design of such transformers has an important effect on overall system weight, power-inversion efficiency, and cost. Relationships were between

the parameters used by transformer designers that can be used as new tools to standardize and simplify transformer design. They can be used to optimize the design either for small size and weight or efficiency. The metric system of units, rather than the familiar English units, is used; however, material is presented to assist the reader in the transition from one system to the other. Author

N77-24385*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A REGULATED HIGH EFFICIENCY, LIGHTWEIGHT CAPACITOR-DIODE MULTIPLIER DC TO DC CONVERTER Patent Application
W. T. Harrigill and Ira T. Myers, inventors (to NASA) Filed 27 May 1977 12 p
(NASA-Case-LEW-12791-1; US-Patent-Appl-SN-801432) Avail: NTIS HC A02/MF A01 CSCL 09A

A voltage multiplier is described which has a capacitor-diode voltage multiplying network which is fed with voltage pulses from a dc source through a first switching means. Pulses of a second polarity are also supplied through a second switching means to the input of the capacitor-diode voltage multiplier from a second dc source whose voltage is adjustable to change the voltage of the pulses of second polarity. The switching means are alternately rendered conducting by signals from a control circuit. The second dc source may be controlled by a voltage comparator which compares the output voltage of the capacitor-diode voltage multiplier to the reference source. NASA

N77-24386# Oak Ridge National Lab., Tenn.
HIGH VOLTAGE RESEARCH (BREAKDOWN STRENGTHS OF GASEOUS AND LIQUID INSULATORS) Quarterly Report, period ending 30 Jun. 1976
L. G. Christophorou, D. R. James, R. Y. Pai, M. O. Pace, R. A. Mathis, and D. W. Bouldin Sep. 1976 53 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5604; QR-1) Avail: NTIS HC A04/MF A01

The breakdown strengths of a number of unitary and multicomponent gaseous insulators chosen on the basis of their interactions with slow electrons were measured. The breakdown strengths of the perfluorocarbons c-C4F8, iso-C4F8 and C4F6 were found to be higher than SF6 by approximately 35 percent, approximately 63 percent and greater than 100 percent, respectively. This was attributed to the higher attachment cross sections for the perfluorocarbons in the energy range 0.4 to approximately 1.5 eV. Similar results were obtained for the mixtures c-C4F8/CCl4, C6F6/c-C4F8 and C6F6/SF6. The breakdown strengths increased as c-C4F8 < iso-C4F8 < C4F6, indicating the importance of the double bond in iso-C4F8 and the triple bond in C4F6 in controlling breakdown. The fundamental physiochemical data on many promising gaseous insulators were reviewed, and an extensive collection of promising samples was acquired. ERA

N77-24387# Oak Ridge National Lab., Tenn.
FORTRAN PROGRAMS FOR TRANSIENT EDDY CURRENT CALCULATIONS USING A PERTURBATION-POLYNOMIAL EXPANSION TECHNIQUE
K. H. Carpenter Nov. 1976 69 p refs
(Contract W-7405-eng-26)
(ORNL/CSD/TM-18) Avail: NTIS HC A04/MF A01

A description is given of FORTRAN programs for transient eddy current calculations in thin, nonmagnetic conductors using a perturbation-polynomial expansion technique. Basic equations are presented as well as flow charts for the programs implementing them. The implementation is in two steps; (1) a batch program to produce an intermediate data file, and (2) interactive programs to produce graphical output. FORTRAN source listings are included for all program elements, and sample inputs and outputs are given for the major programs. ERA

N77-24388# Bendix Corp., Kansas City, Mo.
WELDING OF HERMETIC CONNECTORS
D. E. Hieber Aug. 1976 38 p ref
(Contract E(29-1)-613)
(BDX-613-1293-Rev; PDO-6984855) Avail: NTIS HC A03/MF A01

Certain systems use hermetically-sealed multipin connectors welded into a stainless steel support ring. Failure of these hermetic seals during welding continues to be a problem, and similar problems are anticipated on advanced systems. Since the assembly is expensive, and the detection, prevention, and repair of hermetic seal failures is costly, development of an improved welding process is important. Extended service life also requires a lower system leak rate, thus causing an increased need for maintaining the hermetic seal without supplemental epoxy sealing and repair. Experience shows that up to 70 percent of the 10-pin SA1810-2 connectors have gross leaks (greater than 0.003 cu mm/s standard temperature and pressure (STP)) after being welded using established welding processes and without using the epoxy preseal process. Acceptable leak rates of less than 0.00001 cu mm/s STP were achieved from 20 SA1810-2 10 pin connectors using heat sinks and an intermittent gas-tungsten-arc weld technique. ERA

N77-24389# Oak Ridge National Lab., Tenn.
HIGH VOLTAGE RESEARCH (BREAKDOWN STRENGTHS OF GASEOUS AND LIQUID INSULATORS) Quarterly Report, period ending 30 Sep. 1976
L. G. Christophorou, D. R. James, R. Y. Pai, M. O. Pace, R. A. Mathis, D. W. Bouldin, and D. E. Tittle Dec. 1976 25 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5713; QR-2) Avail: NTIS HC A02/MF A01

Progress in measuring and studying the breakdown characteristic of gases which can be used in gas-insulated cables for 300 kV power transmission lines is reported. The gases studied include C4F6, C4F8, and SF6. The experimental apparatus and measuring methods are described. ERA

N77-24390# European Space Agency, Paris (France).
OPTIMAL DIMENSIONING OF SERVO SYSTEMS WITH DIGITAL, ANALOG OR SYNCHRO INPUT SIGNALS
Friedrich Erdmann et al Apr. 1977 50 p refs Transl. into ENGLISH of 'Optimale Dimensionierung von Kleinstservosystemen mit digitalem, analogem oder Drehfeld-Eingangssignal', DFVLR, Brunswick Report DLR-FB-76-37, 8 Jul. 1976 Original report in GERMAN previously announced as N77-13428 Original German report available from DFVLR, Cologne DM 19.80
(ESA-TT-339; DLR-FB-76-37) Avail: NTIS HC A03/MF A01

A method of optimal dimensioning for electromechanical, velocity-controlled servo systems with digital, analog, or 3-phase (synchro) input signals is presented. It is assumed that the maximal error for a maximal constant velocity is given; for this, formulas were developed via a mathematic model. For each of the three types of servo system, an example is given for verifying and demonstrating the theoretically found background. Author (ESA)

N77-24391# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE MINIMUM ACHIEVABLE QUALITY FACTOR OF A SMALL OMNIDIRECTIONAL ANTENNA CONTAINED IN A SPHEROID
H. Vissinga Mar. 1976 34 p refs
(PhL-1976-14; TDCK-67620) Avail: NTIS HC A03/MF A01

The minimum quality factor of an antenna contained in a spheroid is calculated under the assumptions that the antenna is small relative to a wavelength and omni-directional. The results are presented in the form of tables and curves. Author (ESA)

N77-24392# Physics Lab. RVO-TNO, The Hague (Netherlands).
SOME ASPECTS OF THE DESIGN OF IMPATT-DIODE OSCILLATORS ON MICROSTRIP
L. J. Glimmerveen Jun. 1976 64 p refs
(PhL-1976-25; TDCK-67959) Avail: NTIS HC A04/MF A01

Some aspects of the design procedure of a microstrip-IMPATT diode-oscillator are described where the possibility of incorporating solid-state components in microstrip transmission lines is used successfully. The development of these oscillators, together with diode-phase-shifters, was started for the realization of array modules for active phased-array-radar antennas. A brief description of the construction and the performance of the oscillator is given. Other topics described are: a method to tune the oscillator circuit to a desired oscillation frequency, a method to tune the oscillator circuit for maximum power output, the possibilities of phase locking, and a method to determine the complex impedance of the Impatt diode. Author (ESA)

N77-24393# Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.

INSTALLATION OF THE CIRCULAR WAVEGUIDE TRANSMITTING MEDIUM [PROBLEMI E TECNICHE DI INSTALLAZIONE DEL MEZZO TRASMISSIVO IN GUIDA D'ONDA CIRCOLARE]

Gian Carlo Corazza (Bologna Univ.), Luigi LoVecchio, and Guido Magni (Soc. Ital. Reti Telefoniche Interurbane) 5 May 1976 47 p refs In ITALIAN

Avail: NTIS HC A03/MF A01

The requirements for installation and protection of a circular waveguide circuit are surveyed. These circuits consist of steel tubes installed underground. An Italian experimental circular waveguide circuit is described, the alignment of which was carried out using a laser. Experimental circuits in other countries are reviewed. ESA

N77-24394# Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.

MEASUREMENT OF REPEATER CHARACTERISTICS IN CIRCULAR WAVEGUIDES [METODI DI MISURA DELLE CARATTERISTICHE DI APPARECCHIATURE RIPETITRICI IN GUIDA D'ONDA CIRCOLARE]

Luciano Buti (Centro Studi e Lab. Telecomun.) 28 May 1976 31 p refs In ITALIAN

Avail: NTIS HC A03/MF A01

Methods of measurement for checking the performance of repeater equipment in circular waveguide communication are considered. In view of the high frequencies utilized and the high transmission speed, group delay tests as well as error rate measurements are highlighted and their implementation for the Italian system illustrated. ESA

N77-24395# Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.

SPECIAL PASSIVE COMPONENTS IN CIRCULAR WAVEGUIDES [COMPONENTI SPECIALI PASSIVI IN GUIDA D'ONDA CIRCOLARE]

Paolo Bernardi (Centro Studi e Lab. Telecomun.) and Franco Bertolani 18 May 1976 33 p refs In ITALIAN

Avail: NTIS HC A03/MF A01

Several solutions to circular waveguide coupling and installation problems are surveyed. Mode transformers for conversion of the TE10 rectangular guide mode to circular guide modes are discussed, together with directional couplers between the guide types and tapers for diameter adaption. Sudden deviation of the guide axis is dealt with, and the reduced diameter curved guide, and elbows with electromagnetic mirrors, are suggested. Mode filters and thermal dilatation joints are also discussed. ESA

N77-24396# Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.

MEASUREMENT AND CHARACTERIZATION OF THE CONSTRUCTION AND INSTALLATION IMPERFECTIONS OF A CIRCULAR WAVEGUIDE [MISURE E CARATTERIZZAZIONE DELLE IMPERFEZIONI DI COSTRUZIONE E POSA DELLA GUIDA D'ONDA CIRCOLARE]

Gabriele Falciasecca (Bologna Univ.), Luigi LoVecchio, and Guido Magni (Soc. Ital. Reti Telefoniche Interurbane) 15 May 1976 30 p refs In ITALIAN

Avail: NTIS HC A03/MF A01

The theoretical background for dealing with geometrical deformations of circular waveguides is presented, and some examples of test benches constructed in Italy and abroad are described. ESA

N77-24397# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

INVESTIGATIONS OF AN ADAPTIVE TWO-ELEMENT SPATIAL FILTER USING DIGITAL SIGNAL PROCESSING [UNTERSUCHUNGEN AN EINEM ADAPTIVEN ZWEIELEMENT-RAUMFILTER BEI VERWENDUNG DIGITALER SIGNALVERARBEITUNG]

B. Naegele Jun. 1976 31 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(Rept-3-76) Avail: NTIS HC A03/MF A01

The realization of a two-element adaptive antenna using a HP 2100 S digital computer is described. After having digitized the received signals at the two elements, computation of the optimum weighting factor (in the sense of maximizing the ratio of the signal power from a desired direction to the signal power from another direction) was performed in real time. Narrow band signals at a carrier frequency of 5 kHz and a bandwidth of 360 Hz were used. Author (ESA)

N77-24398# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF AN ADAPTIVE 3-ELEMENT SPATIAL FILTER [THEORETISCHE UND EXPERIMENTELLE UNTERSUCHUNGEN AN EINEM ADAPTIVEN 3-ELEMENT-RAUMFILTER]

M. Weber Jun. 1976 53 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(Rept-4-76) Avail: NTIS HC A04/MF A01

Investigations of a three-element adaptive line array (Triplet) are described. A calculation of the optimum filter weights is presented, which, in the mean square error sense, minimize the interference noise at the system output. It is shown that for the model chosen the output S/N-ratio will, hereby, be maximized. As an appropriate system performance a gain factor is derived, based upon the ratio of the noise power at the conventional beam former to that one at the adaptive antenna output. The spatial distribution of the interference sources and the bandwidth influence were varied to study their effects on the performance. Another characteristic parameter, the adaption time of the system, was investigated for different interference configurations. The analog realization of the triplet, a three-element-control loop-processor is described, and experimental results are compared with the precalculated values.

Author (ESA)

N77-24399# National Bureau of Standards, Washington, D. C. Electronic Technology Div.

SEMICONDUCTOR MEASUREMENT TECHNOLOGY: ARPA/NBS WORKSHOP 3: TEST PATTERNS FOR INTEGRATED CIRCUITS Final Report

Harry A. Schafft, ed. Jan. 1976 56 p refs Conf. held at Scottsdale, Ariz., 6 Sep. 1974

(ARPA Order 2397)

(PB-263178/6; NBS-SP-400-15; LC-75-619388) Avail: NTIS HC A04/MF A01 CSCL 09E

The use and development of MOS and bipolar test patterns and associated data acquisition systems were considered. Discussions revealed that device manufacturers and users are making increased use of test patterns as powerful new measurement tools that can electrically monitor various process parameters to aid in the control of materials, wafer processes, circuit performance, and reliability. However, the large volume of data generated from these test patterns and the requirement for rapid diagnostic feedback present severe challenges in data management and display. Several data acquisition systems are described, as are approaches for presenting data in more easily interpretable graphic displays. The need for improvements in the design of test patterns is emphasized. In particular, problems with measuring contact resistance and the properties of oxides, surfaces, and defects, are identified. Numerous test structures are described including charge coupled device structures which can measure some characteristics not easily measured by other means. Efforts and plans to identify, analyze, and intercompare selected test structures and to develop measurement methods for use with these structures are also discussed. GRA

N77-24400# Avantek, Inc., Santa Clara, Calif.

ANNUAL REPORT, 2 JUNE 1975 - 1 JUNE 1976

24 Nov. 1976 191 p refs

(Contract N00014-75-C-1163)

(AD-A034682) Avail: NTIS HC A09/MF A01 CSCL 09/1

This report covers work on a 12 month (Phase 1) program which had the objective of developing a FET and amplifiers covering the 7-15 GHz range. A 0.5 micron gate FET was successfully developed and the amplifiers were delivered on schedule. Technology development to improve FET performance as well as new techniques in amplifier design are discussed in this report. FET performance, materials development, and amplifier components are also described in detail. GRA

N77-24401# RCA Solid State Technology Center, Somerville, N. J.
HIGH-RELIABILITY, LOW-COST INTEGRATED CIRCUITS Quarterly Report, 3 Aug. - 3 Nov. 1976
3 Nov. 1976 48 p
(Contract N00039-76-C-0240)
(AD-A034603; QR-3) Avail: NTIS HC A03/MF A01 CSCL 09/5

Wafer fabrication for sample generation has been completed on all integrated-circuit types. The critical experiments completed to data have resulted in the unification of the COSMOS and bipolar metallization processes, optimization of the gold-interconnect thickness, development of a suitable COSMOS silicon nitride-silicon oxide gate dielectric, and optimization of the gold bond-pad height. The platinum layer thicknesses required for an effective diffusion barrier and platinum silicide formation have been determined. Preliminary reliability testing has been initiated and data generated on a 250 C bias-life test. A failure mechanism associated with high temperature life tests and epoxy molding compounds has been identified; packaging techniques designed to eliminate this failure mode are being investigated. A preliminary cost baseline has been established. Author (GRA)

N77-24402# Aerospace Corp., El Segundo, Calif. Reentry Systems Div.
ELECTRICALLY SMALL COMPLEMENTARY PAIR (ESCP) WITH INTER-ELEMENT COUPLING Interim Report
Klaus G. Schroeder 10 Dec. 1976 29 p refs
(Contract F04701-76-C-0077)
(AD-A033862; SAMSO-TR-76-17; TR-0077(2550-63)-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

Electrically small (reduced size) antennas are inherently narrowband, or inefficient, or both. A summary is presented of prior work on complementary pair antennas and the use of the coupling between the two elements to optimize the impedance match and efficiency of such structures. The design of electrically small complementary pairs is described, and preliminary measurement results are shown for monopoles. These measurements indicate a substantial improvement in gain-bandwidth product as compared to conventional matching techniques for electrically small antennas. In addition, the complementarization circuit in conjunction with the hybrid feed can reduce the effects of mutual impedances in steerable-beam arrays. Applications include small individual antennas and scatterers as well as linear, planar, or circular arrays in a variety of fixed-station or vehicular uses. Various types of decoys and ECM systems for aircraft and missiles are examples of potential applications of electrically small antennas and scatterers. Large, hardened, ground-based phased arrays and wideband communication base station antennas are typical phased-array applications in fixed stations. Vehicular applications encompass wideband direction finders, aircraft conformal antennas for various functions, and high-performance spacecraft antennas for communications and radar systems. Author (GRA)

N77-24403# Army Armament Command, Rock Island, Ill. Systems Analysis Directorate.
BREAK-EVEN ANALYSIS OF VADS, M163, ANTENNA PROTECTION DEVICE Final Report
Richard D. Husson and David M. Johnson Jul. 1976 15 p
(AD-A033926; DRSAR/SA/N-52) Avail: NTIS HC A02/MF A01 CSCL 09/5

This note presents a break-even analysis conducted to determine how much can be spent (per device) for an antenna protection device for the radar on the Vulcan M163 System. The present value of costs without a protective device was equated to the present value of estimated costs with a protective device. This analysis gives the maximum amounts that can be spent on protective devices for varying degrees of protection.
Author (GRA)

N77-24404# Purdue Univ., Lafayette, Ind.
THE EFFECTS OF SUBSTRATE COMPOSITION ON THICK FILM CIRCUIT RELIABILITY Quarterly Technical Report, 1 Aug. - 31 Oct. 1976
R. W. Vest 30 Nov. 1976 23 p refs
(Contract N00019-76-C-0354)
(AD-A033963; QTR-3) Avail: NTIS HC A02/MF A01 CSCL 09/5

During this quarter's studies of the rate of the dissolution of 99.5 percent Al2O3 substrates (AlSiMag 772) in the model glass (63 percent PbO, 25 percent B2O3, 12 percent SiO2) were conducted as a function of time at 800 C. The results were similar to those reported earlier for 96 percent Al2O3 substrates (AlSiMag 614) and were consistent with the proposed rate limiting steps of phase boundary reaction rate control at short times and diffusion through a boundary layer under natural convection at longer times. The dissolution rate of AlSiMag 614 substrates was measured at short contact times (3-15 minutes) by atomic absorption techniques and were in good agreement with values predicted by extrapolation of longer time data at 800 C. Studies of the distribution of substrate ingredients throughout the resistor glass at 800 C as a function of time showed that the boundary zone at the interface across which the concentrations change has a width of approximately 3 micrometers and is independent of contact time. Studies of the influence of substrate constituents dissolved in the glass on electrical properties of resistors uncovered a significant effect on temperature coefficient of resistance (TCR). Low TCR characteristics of reliable thick film resistors cannot be achieved with the model system unless an appreciable amount of substrate material is dissolved in the resistor glass.
Author (GRA)

N77-24405# Northrop Corp., Des Plaines, Ill. Defense Systems Dept.
LOW COST EXPENDABLE TWT AMPLIFIER FOR ECM Final Report, 23 Apr. 1975 - 1 May 1976
O. Doehler and R. Moats Aug. 1976 116 p refs
(Contract N00173-75-C-0464)
(AD-A033885) Avail: NTIS HC A06/MF A01 CSCL 17/4

Preliminary design of the low cost TWT included a cost analysis, which indicated the division of approximately 50% for material and 50% for labor at the manufacturing cost level was appropriate to medium power TWT's. It was observed during this analysis that a significant percentage of the labor was devoted to alignment and testing of the tube. Thus, in addition to reducing the cost of material in assembly labor going in tube construction, consideration must be given to the realization of design which would minimize alignment and test time. Mechanical and electrical designs for the electron gun and focusing structure were considered in detail. Alternative designs were studied to determine which would yield the lowest cost, without compromising shelf life and performance. This study led to a stacked metal ceramic electron gun construction capable of withstanding the high bake-out temperature required to obtain the shelf life. The study of the metal-to-ceramic vacuum seal was confined to a beaded header utilizing Hybralox, a new inexpensive material capable of withstanding high temperatures. The PPM focusing structure constructed independent of the vacuum envelope was shown to be the lowest cost focusing method which could be realized with reasonable weight and efficiency. A detailed trade-off study on the methods of fabrication for the major cost items in the gun and focusing structure was considered. GRA

N77-24406# Iowa Univ., Iowa City. Div. of Information Engineering.
THE ELECTRICAL PROPERTIES OF SPUTTERED GALLIUM ARSENIDE FILMS Final Report, 1 Nov. 1975 - 31 Aug. 1976
Rodney J. Soukup 31 Oct. 1976 79 p refs
(Grant AF-AFOSR-2941-76; AF Proj. 6813)
(AD-A033091; AFOSR-76-1226TR) Avail: NTIS HC A05/MF A01 CSCL 20/12

As a consequence of the difficulty in making measurements on planar GaAs samples this study concentrated on metal-GaAs-metal (Al, Mg, Mn) sandwich structures. The alternating current and direct current measurements made on these structures are described, and the results are presented. The objective was to determine the electrical properties of highly disordered films of GaAs deposited by sputtering with and without co-sputtering of p-type and n-type dopants. The ac analysis included a measure of the impedance, magnitude and phase angle of these structures over a wide range of frequencies and temperatures. The results indicated that the model which describes these structures is a series combination of two parallel RC networks. The physical model which would result in this equivalent circuit model is

that of a leaky Schottky barrier in series with 'bulk'. As a check on this model the equivalent parallel capacitance of these structures was measured at high and low frequency and over a temperature range, and these results verified this conclusion. GRA

N77-24407# United Technologies Research Center, East Hartford, Conn.
MODE LOCKED SURFACE ACOUSTIC WAVE OSCILLATOR FOR COHERENT FREQUENCY SIGNAL SYNTHESIS Final Report
M. Gilden and T. M. Reeder Sep. 1976 59 p refs
(Contract N66001-76-C-0011)
(AD-A034177; UTRC-R76-922155-3) Avail: NTIS HC A04/MF A01 CSCL 09/5

A new type of frequency synthesizer utilizing Mode Locked SAW oscillators, CZT transducers, and rapidly switchable nonlinear diodes was experimentally demonstrated to be both feasible and promising. The conclusions from this work with a first preliminary model are as follows: The Mode Locked SAW Oscillator (MLSO) is able to provide a set of synchronized and stable short rf pulses with lengths in the range of 50 to 100 nseconds. These pulses can efficiently drive a set of CZT transducers that are used for generating counter flowing SAW discrete chirp signals. By using the sum frequency, signals are synthesized directly at rf frequencies. The Chirp Z Transform approach to frequency synthesis is particularly attractive because it provides means for switching frequencies in a coded sequence within time intervals as short as 50 ns. This was achieved experimentally in the present program. Equally important is the fact that the frequencies are determined only by the physical position of the selected taps. GRA

N77-24408# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
ELECTROMAGNETIC INTERFERENCE EFFECTS ON MOTOR VEHICLE ELECTRONIC CONTROL AND SAFETY DEVICES. VOLUME 1: SUMMARY Final Report, 1 Mar. 1975 - 1 Jul. 1976
R. H. Espeland, D. H. Layton, B. D. Warner, L. R. Teters, and E. L. Morrison, Jr. Nov. 1976 24 p refs
(Contract DOT-HS-5-01097)
(PB-261765/2; DOT-HS-802107-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 13F

A computerized coupling analysis program was used to determine the effects of body shielding, aperture size, and cable lengths on signal coupling in the 100 to 200 MHz band between a simulated mobile radio emission and a modeled air cushion restraint system cable as it might be used in a motor vehicle. A series of susceptibility tests were performed on an electronic speed control system and an antiskid control module to determine functional upset levels of injected signals at critical circuit ports on these devices. The upset criteria were based on performance departures from normal, resulting from the injection of interfering signals. GRA

N77-24409# Defense Electric Power Administration, Washington, D.C.
ELECTRIC POWER SYSTEMS VULNERABILITY METHODOLOGY Final Report
Brian K. Lambert Aug. 1976 116 p refs
(Contract OCD-PS-66-92)
(AD-A033910) Avail: NTIS HC A06/MF A01 CSCL 10/2

This report presents expanded and updated overpressure versus damage estimates for major electric power system components and fundamental planning guidelines for damage estimation procedures. The data contained in the report can provide planners with the necessary information to identify critical components in an electric power system, estimate potential damage, establish priorities for resource allocation and management in the event of system disruption, and make tentative repair effort estimates. Analysis and evaluation of the data reveals that due to the complexity of an electric power system and because many major components would be exposed to direct weapons effects, system disruption could occur at relatively low levels of overpressure. Also, as overpressure values increase, massive restoration efforts will be required. In addition, complex spare parts are not readily available and, as a result, will pose a major post-attack problem. The report also contains a state-of-the-art discussion, a description of major components and their relationship to the functioning of the overall system, and an annotated bibliography. Author (GRA)

N77-24410# Battelle Columbus Labs., Ohio.
DESTATOR TEST PROGRAM EVALUATION Final Report, 26 Feb. 1974 - 31 Aug. 1976
S. A. Hawk and R. B. Reif 8 Jul. 1976 41 p refs
(Contract DOT-CG-23223)
(AD-A034260; USCG-D-130-76) Avail: NTIS HC A03/MF A01 CSCL 13/12

Explosions that occurred in three very large crude tankers in December, 1969, called attention to a probable electrostatic problem related to washing operations in the large tanks. The Destator is a system designed to sense charge in a tank being cleaned and to control the magnitude of that charge. The report is an evaluation of those tests. Conclusions and comments are given. GRA

N77-24411# Washington Univ., St. Louis, Mo. School of Engineering and Applied Science.
STUDIES OF PRINCIPLES FOR THE ALL DIGITALLY CONTROLLED AND OPERATED POWER SYSTEM Progress Report
John Zaborszky 30 Mar. 1976 409 p refs
(Grant NSF AER-74-22964)
(PB-262695/0; NSF/RA-760083) Avail: NTIS HC A18/MF A01 CSCL 09C

An integrated operation for economic dispatch and load frequency control is discussed along with the system wide generation allocation problem. The coordinated digital control of system wide stability augmentation through local augmentation action is also considered. A state space for the large interconnected power system in which the state of the system can be estimated piecewise by local computations from conventional local measurements is introduced. GRA

N77-24412# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
INTERFACE STATES IN SCHOTTKY BARRIER DIODES Interim Report
Jose M. Borrego and Ronald J. Gutmann Griffiss AFB, N. Y. RADC Aug. 1976 121 p refs
(Contract F19628-74-C-0102)
(AD-A034425; RADC-TR-76-266; Scientific-1) Avail: NTIS HC A06/MF A01 CSCL 09/1

The electrical behavior of Schottky barrier junctions before and after neutron irradiation have been explored. Guarded Au/nGaAs diodes were fabricated from bulk and epitaxial material with a preirradiation n factor of 1.03 and saturation current density of 10 to the minus 8th power amps/sq cm. After irradiation with low neutron fluences (i.e., carrier removal less than 10%) the reverse current increased by one to two orders of magnitude with only a slight increase in n factor. I-V and C-V measurements from 77K to 360K and photoelectric measurements at room temperature were taken in developing an understanding of the effect of neutron irradiation on the electrical characteristics of these Schottky barrier diodes (including with transient ionizing radiation). The experimental results have been interpreted from an interface state density model as suggested by Levine. The results of this model have been compared to those reported by Levine and Crowell and Roberts with unirradiated diodes. The limitations of interpreting the results using the interface state density model have been delineated experimentally. Calculations indicate that current from field-enhanced emission is present in addition to thermionic emission current from the interface state model. Implications of these results on the use of Schottky junction devices in neutron radiation environments are presented. Author (GRA)

N77-24413# Pennsylvania State Univ., University Park. Applied Research Lab.
MECHANICAL ANTIVIBRATION FILTER DESIGN USING ELECTRICAL NETWORK SYNTHESIS TECHNIQUES M.S. Thesis
Craig B. Putman 7 Apr. 1976 102 p refs
(Contract N00017-73-C-1418)

(AD-A034460; TM-76-162) Avail: NTIS HC A06/MF A01 CSCL 13/9

Two methods are presented by which mechanical low-pass filters can be designed using electrical network synthesis techniques. The desired response can be any low-pass filter function that is realizable as a planar reactive ladder network. The resultant response of the synthesized network will be slightly different from the desired response, but this difference is predictable and can be taken into account when considering the specifications for the design of the filter. These techniques can be used to design either a filter network with a relatively small source mass driven by a constant force or a filter network with a relatively large source mass moving with a constant velocity. The two methods are compared and an example is given to illustrate the implementation of one of the methods.

Author (GRA)

N77-24414# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.

SERVO TECHNIQUES IN OSCILLATORS AND MEASUREMENT SYSTEMS

Fred L. Walls and S. R. Stein Dec. 1976 27 p refs

(PB-263632/2; NBS-TN-692) Avail: NTIS HC A03/MF A01 CSCL 14B

The errors and offsets of frequency-lock loops which result from background, noise and other effects are studied. Third harmonic lock systems and square wave frequency modulation are analyzed as possible solutions to some of these problems. Servo system response which is applicable to both frequency and phase-lock loops is examined. The effects of noise on such servo systems are discussed in detail, and an example is given of how to obtain optimum performance from a pair of phase-locked oscillators. A simple circuit is suggested for phase-locking high quality oscillators.

GRA

N77-24415# Pennsylvania Univ., Philadelphia. Dept. of Mechanical Engineering and Applied Mechanics.

THERMAL AND ELECTRICAL CHRACTERISTICS OF A TWO-DIMENSIONAL TANH-CONDUCTIVITY ARC Interim Report

P. S. Ayyaswany, G. C. Das, and I. M. Cohen Dec. 1976 24 p refs Sponsored by EPRI

(PB-262624/0; MEAM-76-9; EPRI-378-1-4) Avail: NTIS HC A02/MF A01 CSCL 20C

The numerical evaluation is carried out by the use of a Galerkin technique. The results exhibit several novel features depending on the arc parameters. For large aspect ratios (ratio of the interelectrode distance to that between the bounding walls) and small electrode temperatures, the current-electric field characteristics tend toward those of a slender arc. At a given aspect ratio, however, with large enough electrode temperatures, the distinct minimum noticed in the slender arc characteristics does not occur. Also, for a given aspect ratio and large enough differences in electrode potential, the electric field-current characteristic is nearly linear and is independent of the electrode temperature. The transverse electrostatic potential is found to have no significant variation in cross-sectional planes. The qualitative nature of the thermal characteristics are similar to those of a constant-property arc although significant differences in quantitative results exist. Wall and electrode heat transfer rates are provided.

GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N77-24416 British Library Lending Div., Boston Spa (England).

EXCHANGE OF HEAT AND MOMENTUM IN TWO-PHASE FLOWS

J. M. Chawla Mar. 1977 14 p refs Transl. into ENGLISH from Chlodnictwo (W. Ger.), v. 8, no. 10, 1973 p 8-12

(BLL-RTS-9966) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Heat and momentum transfer in two phase flows of vapors and liquids in the tubes of evaporators and condensers are discussed. The problem of local pressure drop due to friction along the pipes is considered. The determination of heat transfer coefficients is also discussed. Numerical techniques are utilized for the evaluation of these problems.

D.M.L.

N77-24417 British Library Lending Div., Boston Spa (England).

RELATIONSHIP BETWEEN HEAT TRANSFER AND PRESSURE DROP IN TURBULENT FLOW

F. Steimle Mar. 1977 12 p refs Transl. into ENGLISH from Kaltetechnik-Klimatisierung (W. Ger.), v. 23, no. 4, 1971 p 126-128

(BLL-RTS-9970) Avail: NTIS Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

On the basis of Prandtl's theory and Schlichting's boundary layer equations, a relationship was derived which, in two newly introduced indices Nu sub m and SK, contains only the reduced pressure drop delta p/L, the heat transfer coefficient alpha, the mass flow m in kg/s and thermophysical constants. According to the derivation, the power of the index SK is 0.37. This value can be verified by the results of measurements for different types of flow.

Author

N77-24418 British Library Lending Div., Boston Spa (England).

HEAT TRANSFER DURING THE EVAPORATION OF REFRIGERANTS IN HORIZONTAL SMOOTH AND FINNED TUBES

G. Homman Mar. 1977 14 p refs Transl. into ENGLISH from Luft- und Kalte-Technik (W. Ger.), v. 6, no. 2, 1970 p 90-93

(BLL-RTS-9971) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Heat transfer during the evaporation of refrigerants in horizontal flow tubes is considered with emphasis on the evaporation process. Equations of the heat transfer are presented for the case of two phase flow in horizontal tubes. Smooth and finned tubes are included.

J.M.S.

N77-24419 British Library Lending Div., Boston Spa (England).

PRESSURE INFLUENCE ON HEAT TRANSFER DURING FULLY DEVELOPED BUBBLE EVAPORATION

D. Vaihinger and W. D. Kaufmann Mar. 1977 19 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (West Ger.), v. 44, no. 15, 1972 p 921-927

(BLL-RTS-9958) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Evaporation tests were conducted using the refrigerant difluorodichloromethane in forced convection through a vertical tube with the flow directed upwards. The internal diameter of the stainless steel test span was 20.5 mm, with the heat load being applied indirectly to a length of around 1,600 mm. A dimensionless heat transfer equation for the region of developed bubble evaporation was derived. Using this equation, foreign measurement results may be reproduced from tests with a variety of refrigerants over a wide pressure range during natural and forced convection with a mean variation of plus or minus 15 percent. Satisfactory agreement between measurement and calculation can also be obtained for evaporating water and some organic liquids.

Author

N77-24420 British Library Lending Div., Boston Spa (England).

INFLUENCE OF HEAT FLOW DENSITY ON THE TRANSFER PERFORMANCE OF EVAPORATORS IN COOLING PLANTS

G. Mann Apr. 1977 13 p refs Transl. into ENGLISH from Kalte (West Ger.), v. 22, no. 10, 1969 p 537-541

(BLL-RTS-9965) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The avoidance of errors during calculation of evaporators using well known heat transfer equations is discussed. In the

course of evaporation process, there was a major increase in heat transfer coefficients as heat flow density rose. The surface loadings were maximized in order to arrive at small installation dimensions. Author

N77-24421 British Library Lending Div., Boston Spa (England).
HEAT TRANSFER COEFFICIENTS FOR THE REFRIGERANT SIDE VAPORISER TUBES
J. M. Chawla Apr. 1977 3 p ref Transl. into ENGLISH from Kaltetechnik Klimatisierung (West Ger), v. 22, no. 4, 1970 p 2-45
(BLL-RTS-9974) Avail: British Library Lending Div., Boston Spa, Engl.: £3.00; 3 BLL overseas, 3 European or 12 UK BLL photocopy coupons

The mean heat transfer coefficient for complete vaporization or R 11 in tubes is briefly given for refrigerant mass flow density and heating surface loads. The tubes are 13.5 mm in diameter in the graphic representation. An example of this vaporization is presented at 20 C, mass flow density M = 30 kg/sq m, heating surface load q = 15,000 W/sq m, and the tube diameter d = 10 mm. J.A.M.

N77-24422 British Library Lending Div., Boston Spa (England).
CONCERNING A NEW CONCEPTION OF STRUCTURE OF EQUATIONS RELATING TO HEAT-TRANSFER TO SURFACES WITH ARTIFICIAL ROUGHNESSES AND MICROFINS
Maier Perlman Mar. 1977 10 p refs Transl. into ENGLISH from Buletinul Institutului Politehnic din Iasi Sectia 4 (Isai, Rumania), Vol. 18, no. 22, 1972 p 77-82
(BLL-RTS-9977) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The characteristic geometrical-dynamic ratio was introduced into the analysis of the heat transfer process to surfaces with artificial roughnesses and microfins. On the basis of the hypothetical considerations, a logical theoretical substantiation was found leading to the possibility of simplifying the methods for calculation and checking of heat transfer devices. It also leads to possibilities for the generalization and correlation of the existing experimental and theoretical data. Author

N77-24423* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VORTEX GENERATOR FOR CONTROLLING THE DISPERSION OF EFFLUENTS IN A FLOWING LIQUID Patent
Robert C. Costen, inventor (to NASA) Issued 31 May 1977 5 p Filed 3 May 1976 Supersedes N76-23521 (14 - 14, p 1795)
(NASA-Case-LAR-12045-1; US-Patent-4,026,527; US-Patent-Appl-SN-682416; US-Patent-Class-259/4R; US-Patent-Class-261/123; US-Patent-Class-261/DIG.75) Avail: US Patent Office CSCL 20D

A method is disclosed for controlling the dispersion of effluents in a flowing liquid. A vortex generator for creating a distinct recirculating vortical flow is disposed in a flowing liquid and effluents are discharged into the vortical flow. The effluents are entrained in the vortical flow and by selectively positioning the vortex generator the dispersion of the entrained effluents can be controlled. Official Gazette of the U.S. Patent Office

N77-24424*# Old Dominion Univ., Norfolk, Va. Dept. of Mathematics and Computing Sciences.
A NUMERICAL INVESTIGATION OF THE FINITE ELEMENT METHOD IN COMPRESSIBLE PRIMITIVE VARIABLE NAVIER-STOKES FLOW Final Report
C. H. Cook May 1977 62 p refs
(Grant NsG-1098)
(NASA-CR-153217) Avail: NTIS HC A04/MF A01 CSCL 20D

The results of a comprehensive numerical investigation of the basic capabilities of the finite element method (FEM) for numerical solution of compressible flow problems governed by the two-dimensional and axis-symmetric Navier-Stokes equations in primitive variables are presented. The strong and weak points of the method as a tool for computational fluid dynamics are considered. The relation of the linear element finite element method to finite difference methods (FDM) is explored. The calculation of free shear layer and separated flows over aircraft boattail afterbodies with plume simulators indicate the strongest assets of the method are its capabilities for reliable and accurate calculation employing variable grids which readily approximate complex geometry and capably adapt to the presence of diverse regions of large solution gradients without the necessity of domain transformation. Author

N77-24425# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON METHODS OF COMPUTING THE SHAPE OF THIN AXISYMMETRIC CAVERNS
G. V. Logvinovich and V. V. Serebriakov [1975] 9 p refs Transl. into ENGLISH from Gidromekhanika (USSR), no. 32, 1975 p 47-54
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Axisymmetric cavitation flows are analyzed using a linearized formulation. A passage to the limit in the equations of a boundary value problem is utilized for which the surface of a cavitator and a cavern is considered to be the surface of a thin body. The shape of thin caverns in an unbounded steady stream is given particular attention. The investigation is aimed at obtaining limit dependences convenient for computations and to make them as graphic as possible by using simple models. Attention is also paid to finding more exact asymptotic solutions. Author

N77-24426*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FILM COOLING ON THE PRESSURE SURFACE OF A TURBINE VANE
James W. Gauntner and Herbert J. Gladden May 1977 17 p refs
(NASA-TM-X-3536; E-8764) Avail: NTIS HC A02/MF A01 CSCL 20D

Film-cooling-air ejection from the pressure surface of a turbine vane was investigated, and experimental data are presented. This investigation was conducted in a four-vane cascade on a J75-size turbine vane that had a double row of staggered holes in line with the primary flow and located downstream of the leading edge region. The results showed that: (1) the average effectiveness of film-convection cooling was higher than that of either film cooling or convection cooling separately; (2) the addition of small quantities of film-cooling air always increased the cooling effectiveness relative to the zero-injection case; however, (3) the injected film must exceed a certain threshold value to obtain a beneficial effect of film cooling relative to convection cooling alone. Author

N77-24427*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC HEATING IN LARGE CAVITIES IN AN ARRAY OF RSI TILES
L. Roane Hunt Washington May 1977 38 p refs
(NASA-TN-D-8400; L-11221) Avail: NTIS HC A03/MF A01 CSCL 20D

A large panel of reusable surface insulation (RSI) tiles including lost tile cavities was aerothermally tested in the Langley 8 foot high temperature structures tunnel to determine both the heat load within the cavities and the structural performance of the RSI surrounding the cavities. Tests were conducted with a turbulent boundary layer at a nominal free stream Mach number of 6.6, a total temperature of 1800 K, a Reynolds number per meter of 5 million, and a dynamic pressure of 62 kPa. The maximum aerodynamic heating to the floor of the cavity was two to three times the normal surface heating. The cavity heating rates agreed with data from other facilities and were successfully correlated with an empirical equation. A zippering failure occurred to a tile downstream of a double tile cavity when the separated flow attached to the floor of the cavity and forced the tile from its position. Author

N77-24428*# Lockheed Missiles and Space Co., Palo Alto, Calif.
OSCILLATIONS AND STABILITY OF NUMERICAL SOLUTIONS OF THE HEAT CONDUCTION EQUATION
L. A. Kozdoba and E. V. Levi [1976] 4 p refs Transl. into ENGLISH from Popov. AN USSR, Ser. A, Fiz.-Matem. i Tekhn. Nauk (USSR), no. 5, 1976 p 467-470

Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The mathematical model and results of numerical solutions are given for the one dimensional problem when the linear equations are written in a rectangular coordinate system. All the computations are easily realizable for two and three dimensional problems when the equations are written in any coordinate system. Explicit and implicit schemes are shown in tabular form for stability and oscillations criteria; the initial temperature distribution is considered uniform. J.A.M.

N77-24429# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).

TOTALLY-IMPLICIT INTEGRATION OF A LIMITED-AREA GRID POINT MODEL OF THE SHALLOW-WATER EQUATIONS

I. M. Navon and A. Kovetz (Tel-Aviv Univ., Israel) Aug. 1976 30 p refs

(CSIR-SR-WISK-222; ISBN-0-7988-0941-8) Avail: NTIS HC A03/MF A01

Implicit time difference schemes were sequentially applied to the nonlinear shallow water equations on a limited area fine mesh domain, employing semimomentum space differencing. Consistent, well posed boundary conditions were accurately imposed on the finite difference approximation. Energy integral invariants of the model were found to be conserved by the finite difference approximation for 72 hour forecasts. The systems of nonlinear algebraic equations resulting from the finite difference discretization were solved by a linearized iterative procedure. Operator control of the time step allowed the truncation error to be restricted to a prescribed limit. Numerical integration was performed with time steps five times as large as the greatest allowed for by the Courant, Friedrichs and Levy (C.F.L) criterion for explicit time schemes. Author

N77-24430# Massachusetts Inst. of Tech., Oak Ridge, Tenn. School of Chemical Engineering Practice.

DESIGN CONSIDERATIONS FOR CAPILLARY HEAT PIPES AT CRYOGENIC TEMPERATURES

S. P. Sukhia, G. C. Coletta, and H. C. Pellow 13 Oct. 1967 36 p refs

(Contract W-7405-eng-26)

(ORNL-MIT-28) Avail: NTIS HC A03/MF A01

A cryogenic heat pipe was suggested as an efficient means of transferring heat from a cooled component on a spacecraft. A thermodynamic analysis of the heat pipe operation, at cryogenic temperatures, leads to the conclusion that the radiant heat leak into the system establishes a minimum temperature difference for efficient operation-the criterion being the absence of fluid boiling in the wick. A design equation for the maximum heat transport in the wick is presented, and correlations for wicking characteristics and wick dimensions are established. A preliminary design for the spacecraft heat pipe is presented. Operating conditions and physical dimensions of the heat pipe and wick are specified. Possible wick materials and configurations are discussed, and a specific approach for experimentation is recommended. ERA

N77-24431# Los Alamos Scientific Lab., N. Mex.

CERAMIC HEAT PIPE HEAT EXCHANGERS

W. A. Ranken Sep. 1976 8 p refs

(Contract W-7405-eng-36)

(LA-6514-MS) Avail: NTIS HC A02/MF A01

High-temperature strength, resistance to corrosive atmospheres, and moderate cost combine to make ceramic materials an obvious choice for construction of high-temperature thermal energy recuperator systems. Despite these advantages, ceramic recuperators are steadily being replaced by metallic units at considerable sacrifice in maximum air or fuel preheat temperatures and hence in recovery efficiency. By constructing a recuperator from ceramic heat pipes, the number of joints and the thermal stress to which they are subjected can be greatly reduced, and very low leakage rates can, in principle, be obtained. Methods of fabricating ceramic heat pipes are described and a conceptual recuperator design is presented. Potential applications of this type of unit are also briefly discussed. ERA

N77-24432# Los Alamos Scientific Lab., N. Mex.

TORNADO DEPRESSURIZATION AND AIR CLEANING SYSTEMS

W. S. Gregory, K. H. Duerre, P. R. Smith (New Mexico State Univ., Las Cruces), and R. W. Andrae 1976 24 p refs Presented at the ERDA Air Cleaning Conf., Sun Valley, Idaho, 2 Aug. 1976

(Contract W-7405-eng-36)

(LA-UR-76-1474; Conf-760822-13) Avail: NTIS HC A02/MF A01

Analytical and experimental investigations of tornado depressurization effects on air cleaning systems were conducted. A computer code was developed that simulates the internal pressures and flows within an arbitrary ventilation system. Fluid motion equations were formulated based upon lumped component response, isothermal or adiabatic compression of air, and conservation of mass. A computer generated movie was obtained which illustrated the flows and pressures in a simple system. Experimental investigations were also conducted to determine air cleaning component response to high flow rates caused by tornado depressurizaton. The HEPA filter was the principal component under investigation. Experimental apparatus are described, and preliminary test results are presented. ERA

N77-24433# Drexel Univ., Philadelphia, Pa. Dept. of Mathematics.

QUASI STEADY PRIMITIVE EQUATIONS WITH ASSOCIATED UPPER BOUNDARY CONDITIONS

Paul Gordon 1976 82 p refs

(Contract E(11-1)-2360; Grant NSF GA-35093)

(TID-27174) Avail: NTIS HC A05/MF A01

In standard atmospheric problems, a difficulty arises from the fact that the speed of sound, present in the hydrodynamic equations, is much larger than the natural frequencies of the problem. A common solution is the assumption of the hydrostatic relationship. An attempt is made to resolve the problem by analysis of quasi-steady relationships. With this approach, proper resolution of the problem requires knowledge concerning the dependent variables which are in quasi-steady equilibrium with respect to the remaining dependent variables. Thus, a diagnostic equation represents a quasi-steady relationship. A test problem is defined. A criterion is defined so that it can be demonstrated that the numerical computations are part of a convergent sequence. Results of the computations for various upper boundary conditions are discussed. ERA

N77-24434# Addis Translations International, Portola Valley, Calif.

THERMOACOUSTIC INSTABILITY OF THE MOTION OF GAS WITH DISTRIBUTED HEAT SUPPLY

I. G. Krutikova Jun. 1976 64 p refs Transl. into ENGLISH from Russian report no. 99 Prepared for Lawrence Livermore Lab.

(Contract W-7405-eng-48)

(UCRL-Trans-11123) Avail: NTIS HC A04/MF A01

Questions associated with the appearance of thermoacoustic instability during the motion of gas in a channel with supersonic outflow, with a distributed supply of heat, are considered. It is demonstrated that for sufficiently high frequencies the harmonics of the oscillations are stable. The question whether the first tones of the oscillations are stable is solved by a numerical calculation. It is shown that the stability of the flow depends fundamentally on the heat-supply profile. ERA

N77-24435# Argonne National Lab., Ill.

MATHEMATICAL MODEL FOR CROSS-FLOW INDUCED VIBRATIONS OF TUBE ROWS

S. S. Chen Sep. 1976 49 p refs

(Contract W-31-109-eng-38)

(ANL-CT-77-4) Avail: NTIS HC A03/MF A01

A mathematical model for flow-induced vibrations in heat exchanger tube banks is presented which includes the effects of vortex shedding, fluidelastic coupling, drag force, and fluid inertia coupling. Once the fluid forces are known, the model can predict the details of complex tube-fluid interactions: (1) natural frequencies and mode shapes of coupled vibrations; (2) critical flow velocities; (3) responses to vortex shedding, drag force, and other types of excitations; and (4) the dominant excitation

mechanism at a given flow velocity. The analytical results are in good agreement with the published experimental results. ERA

N77-24436# Arbeitsgruppe fuer Ballistische Forschung, Weil am Rhein (West Germany).
HODOGRAPH METHOD FOR UNSTEADY ONE-DIMENSIONAL GAS FLOWS Ph.D. Thesis - Tech. Hochschule Aachen [HODOGRAPHENVERFAHREN FUER INSTATIONAERE EINDIMENSIONALE GASSTROEMUNGEN]
Rudi Heiser Dec. 1975 107 p refs In GERMAN
(ABF-3/75) Avail: NTIS HC A06/MF A01

The basic equations are given for the unsteady one-dimensional flow of a Noble-Abel gas with energy and mass supply and a flow cross section variable in space and time. The equations are transformed in the hodograph plane. A difference method which uses the characteristics in the hodograph plane as grid lines is applied for numerical solution. Examples of a homentropic and a non-homentropic flow are calculated for the piston problem. The possibility of using the Darboux differential equations for the solution is discussed. Since closed solutions exist only in special cases for the piston problem, a general purpose difference method is preferred. ESA

N77-24437# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
SIX INSTABILITY PHASES OF A RING VORTEX AS THE BASIS FOR SCHWENK'S DROP PICTURES CLASSIFICATION [SECHS INSTABILITAETSPHASEN EINES RINGWIRBELS ALS GRUNDLAGE FUER EINE KLASSIFIKATION DER SCHWENK'SCHEN TROPFENBILDER]
Peter E. M. Schneider Aug. 1976 63 p refs In GERMAN
(MPIS-9/1976) Avail: NTIS HC A04/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 15,00

The ring vortex phenomenon occurring when a drop falls into a liquid layer was investigated. The dependence on the drop forming time, the surface tension of the drop, the drop volume, and also the drop weight, of the input velocity of the liquid into the drop during its formation, i.e. the ring vortex flow occurring in the drop during formation, is shown. The drop can be considered a ring vortex with surface tension, and oscillating ring vortex formation in the liquid layer depends on the drop's oscillatory phase. Optimal spreading vortex formation is correlated to minimal ring vortex penetration depth. A classification possibility is based on the six instability phases of the ring vortex formation on the liquid surface. ESA

N77-24438# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
FLOW OSCILLATIONS IN A CHANNEL WITH SUDDEN CROSS SECTION INCREASE [STROEMUNGSSCHWINGUNGEN IN EINEM KANAL MIT QUERSCHNITTSSPRUNG]
J. S. Anderson, W. M. Jungowski, W. J. Hiller, and G. E. A. Meier Aug. 1976 43 p refs In GERMAN
(MPIS-10/1976) Avail: NTIS HC A03/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 12,40

The oscillations of the flow field in a channel with rectangular cross section and a jump in channel width were investigated using high frequency interferometry. Three different types of flow instability were found to lead to flow oscillations. Decreasing pressure difference in the channel leads subsequently to separation oscillations, shock oscillations, and dead water oscillations, the latter being the most important. The oscillation frequency is determined by the channel length. The oscillation mechanism is based on an interaction between compression shock and flow separation. ESA

N77-24439# European Space Agency, Paris (France).
A METHOD FOR CALCULATING TURBULENT BOUNDARY LAYERS USING A FORMULATION OF FIRST-GRADIENT TYPE
Pierre-Marc Riboud Mar. 1977 89 p refs Transl. into ENGLISH of 'Methode de Calcul de Couches Limites Turbulentes Utilisant une Formulation du Type Premier Gradient', ONERA, Paris Report ONERA-NT-1975-8, 1975 Original report in FRENCH previously announced as N77-20035
(ESA-TT-368; ONERA-NT-1975-8) Avail: NTIS HC A05/MF A01

To develop a computer program for calculating a blown boundary layer at the hinge of a lift-augmenting flap, a calculation method was proposed which uses an equation governing the behavior of the Boussinesq coefficient, formulated by Nee and Kovasznay in the case of an incompressible boundary layer. It is shown that, in the inner turbulent zone, the expression for the local equilibrium, production = dissipation, is consistent with that of the logarithmic law for the velocity near the wall. This observation allows the production and dissipation terms to be deduced from the form taken by the logarithmic law in the case of compressible boundary layers, and the Nee-Kovasznay equation to be generalized to such flows. Similarly the persistence of the logarithmic law when the turbulent wall zone is the seat of mechanisms other than turbulent energy production and dissipation led to the adoption of a formulation conceived by Bradshaw and to a modification of the dissipation length in order to represent these supplementary mechanisms in an implicit manner. Knowing how to relate the value of this length to the value of the slope of the logarithmic law allows the wall jet and the blown boundary layer on deflected or undeflected flaps to be calculated. The numerical method is that of Spalding and Patankar, with modifications relating to the calculation of the entrainment rate and the velocity profiles in the viscous layer, and to the representation of the effect of wall curvature on the transverse variation of the static pressure. Author (ESA)

N77-24440# European Space Agency, Paris (France).
AERODYNAMIC STUDY OF THE FLOW IN CAVITIES WITH WALL INJECTION
Jacques Chaumette Apr. 1977 128 p refs Transl. into ENGLISH of 'Etude Aerodynamique de l'Ecoulement dans les Cavites avec Injection Parietale', ONERA, Paris Report ONERA-NT-1976-9, 1976 Original report in FRENCH previously announced as N77-21376
(ESA-TT-372; ONERA-NT-1976-9) Avail: NTIS HC A07/MF A01

The steady flow within a cavity fed through its wall (case of solid propellant grains obtained by machining) was investigated theoretically and experimentally. The influence of the flow issued from a wall cavity on the main two-dimensional flow was examined and the interaction of two perpendicular flows was studied distinguishing several cases according to the assumptions made on the stagnation pressures and the downstream conditions. The fluid was assumed incompressible and inviscid. The flow within cavities fed through their wall was studied. A hydraulic simulation on a two-dimensional model and a visualization of the flow of burnt gases in a small combustor with a window, containing a machined propellant grain, made it possible to lift indeterminations on geometric singularities. In the theoretical study the fluid was assumed incompressible. The assumption of an irrotational flow leads to a physically unacceptable solution. A more thorough study of the boundary layer with injection shows that in the case of large Reynolds number the solution of the real problem may be obtained by assuming the fluid ideal and the flow rotational. The equation of rotational transport was solved and to this end a numerical method was used based on discrete singularities in two-dimensional flow. The theoretical results are in good agreement with experiment. This numerical method was generalized to the case of axisymmetrical flows and the results obtained for the pressure in the rocket engine compared to experimental results described in the literature. Author (ESA)

N77-24441# Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.
AN ANALYTICAL AND EXPERIMENTAL STUDY OF HYDRAULIC VORTEX RESISTORS Final Report
Karl N. Reid and Syed Hamid Jun. 1976 106 p refs
(Contract DAAG39-75-C-0028; DA Proj. 1T1-61102-A-33B; HDL Proj. 302531)
(AD-A034672; HDL-CR-76-028-1) Avail: NTIS HC A06/MF A01 CSCL 20/4

Steady-state empirical and analytical models were developed for symmetric and nonsymmetric vortex resistors. The empirical model for the nonsymmetric (NSVR) configuration (with flow in the high resistance direction) has been developed from experimental data taken on 24 different geometries and at temperatures of 35.0 C to 57.2 C (with MIL-5606A hydraulic oil). The model

predictions exhibit a maximum error of 30 percent over the range of the experimental data. Empirical models were also developed for the NSVR configuration with flow in the low resistance direction, and for the SVR configuration. Approximate analytical models have been developed for the symmetric and non-symmetric vortex resistors. Two steady-state analytical models have been developed for the non-symmetric vortex resistor. A one-dimensional model has been developed for the symmetric vortex resistor configuration. Noise measurements made on three typical NSVR geometries (6.35 mm vortex chamber diameter) indicate that the signal-to-noise ratio (for signal levels up to 1,722 kN/sq m pressure drop) of a vortex resistor operating in the laminar flow regime is better than 900. GRA

N77-24442# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN ANALYTICAL STUDY OF THE EFFECTS OF MASS TRANSFER ON A COMPRESSIBLE TURBULENT BOUNDARY LAYER M.S. Thesis

A. J. Beauregard Dec. 1976 132 p refs
(AF Proj. 2307)
(AD-A034876; GA/MC/76D-3) Avail: NTIS HC A07/MF A01 CSCL 20/4

Given a FORTRAN code that solved for the characteristics of a laminar, transitional, and turbulent boundary layer, the problem was to modify the existing program to predict the boundary layer over a flat plate and sharp nosed axisymmetric cone with mass transfer as a boundary condition at the surface of the model. The surface of the model was maintained at a constant temperature, and only the cases in which air was the transferred gas were studied. To solve this problem, the boundary layer was described by the standard boundary layer equations for continuity, momentum, and energy. Incorporating mass transfer as a boundary condition, the governing equations underwent the transformation of Probstein-Elliott and Levy-Lees. The resulting equations and boundary conditions were solved by finite differencing techniques for nondimensionalized velocity components and temperature at a finite number of nodes in the boundary layer field of flow. GRA

N77-24443# California Univ., Berkeley. Hydraulic Engineering Lab.

HYDRODYNAMIC DAMPING AND ADDED MASS FOR FLEXIBLE OFFSHORE PLATFORMS Ph.D. Thesis

Charles Petrauskas Oct. 1976 111 p refs
(Contract DACW72-69-C-0001)
(AD-A034534; HEL-9-23; CERC-TP-76-18) Avail: NTIS HC A06/MF A01 CSCL 13/13

The dynamic response of deepwater flexible platforms due to wind-generated ocean waves appears to be an important design consideration; therefore, a theoretical and experimental study was made of hydrodynamic damping and 'added mass.' Classical potential theory with linearized boundary conditions was used to study the hydrodynamic damping due to wavemaking and the coefficient of added mass on a vertical surface-piercing cylinder as a function of oscillation frequency, cylinder diameter, water depth, and mode shape. Experiments were conducted to verify the results of potential theory. Rigid vertical cylinders were oscillated with simple-harmonic motion in calm water. Total forces and radiated waves were measured. They compared very well with theoretical values. Other investigators' data also verified the theory. A small experimental study was made in an attempt to verify the hydrodynamic damping implied by the quasi-steady drag-force interaction term of the presently used modified Morison equation to represent the drag force on an oscillating cylinder in waves. Damping was measured for an elastically supported circular cylinder in a steady current. The measured values were up to 4 times lower than the theoretical values. The disagreement appears to be that the experiments were outside the range for which the quasi-steady assumption is valid. Coefficients of added mass were also measured and were found equal to the potential theory value irrespective of the velocity of the current. GRA

N77-24444# ARO, Inc., Arnold Air Force Station, Tenn.

AN INVESTIGATION OF DUCTED, TWO-STREAM, VARIABLE-DENSITY, TURBULENT JET MIXING WITH RECIRCULATION Final Report, 23 May 1975 - 30 Jun. 1976

Roy J. Schulz AEDC Jan. 1977 87 p refs Sponsored by AF
(ARO Proj. R33P-93A; ARO Proj. R33P-59A)
(AD-A034537; ARO-ETF-TR-76-80; AEDC-TR-76-152; AFOSR-76-1087TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

An investigation was conducted of two-stream, variable-density, turbulent jet mixing with recirculation confined within an axisymmetric duct that simulated a combustor configuration. The recirculating flow fields in the combustor simulator were the result of coaxial jet mixing between a central, primary air stream with a velocity of about 650 ft/sec and an annular secondary stream of hydrogen with velocities of 13, 23, or 48 ft/sec, depending on the desired test conditions. Experimental measurements are presented of radial distributions of time-averaged axial velocity and hydrogen mass fraction, axial distributions of time-averaged static pressure on the duct wall, axial velocity on the duct centerline, and hydrogen mass fraction on the duct wall and on the duct centerline. A theoretical study of the experimental flows was also conducted using a finite difference numerical solution technique for the calculation of viscous, recirculating flows. Comparison of theory and experiment shows that the predictive technique and the turbulence transport model require further development before accurate prediction of recirculating turbulent flows can be realized. GRA

N77-24445# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.

INVESTIGATION OF SUBSONIC ANNULAR NOZZLES FOR ENGINE EXHAUST/EXTERNAL FLOW INTERACTION STUDIES Final Report, Aug. 1973 - Jun. 1976

R. J. Matz AEDC Dec. 1976 43 p refs
(AD-A033932; ARO-ETF-TR-76-93; AEDC-TR-76-143) Avail: NTIS HC A03/MF A01 CSCL 21/5

The results of an experimental investigation to determine the feasibility of conducting engine/external flow interaction tests in subsonic annular airstreams are presented. A representative afterbody model with a 4-in.-diam cylindrical forebody, a faired 15-deg boattail, and a 2.68-in.-diam solid body plume simulator was tested in an 8- by 6-ft porous wall wind tunnel and in annular jets produced by 6-, 8-, and 12-in.-diam nozzles. Afterbody Mach number distributions and boattail pressure drag coefficients obtained on the afterbody in the annular jet were compared with wind tunnel results obtained with boattail approach Mach numbers between 0.5 and 1.0. Boundary-layer profiles were also obtained during the wind tunnel and the annular jet tests. GRA

N77-24446# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.

WAVES AND WAVE FORCES

Jerome H. Milgram Nov. 1976 32 p refs
(Grant NOAA-04-6-158-44007)
(PB-263423/6; MITSG-76-19; NOAA-76122913) Avail: NTIS HC A03/MF A01 CSCL 08C

Consideration is given to the general topic of waves and wave forces. The general features of ocean waves are covered and the utility of linear wave theory is explained. Extremal statistics of waves are reviewed. Wave forces are considered. The background theory as well as experiments that indicate when potential theory is valid and when it is not are reviewed. An outline of how wave forces are calculated by potential theory is given. GRA

N77-24447# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.

ON THE GROWTH OF STEAM DROPLETS FORMED IN A LAVAL NOZZLE USING BOTH STATIC PRESSURE AND LIGHT SCATTERING MEASUREMENTS

Clifford A. Moses and Gilbert D. Stein Jan. 1977 46 p refs
(Contract N00014-76-C-0378; NR Proj. 092-544)
(AD-A034402; TR-1) Avail: NTIS HC A03/MF A01 CSCL 07/4

A series of experiments on steam condensation have been made in a Laval nozzle over a variety of starting conditions such that the onset of condensation occurs in the range -40 to 40 C. The homogeneous nucleation and growth of the new phase is documented with both static pressure and laser light scattering. Since even at onset the majority of the condensed

phase is due to droplet growth the nucleation and growth are coupled and the availability of two measured quantities is helpful in comparing a particular combination of nucleation rate and growth law. For detailed calculations on one of the experiments there is excellent agreement with both measurements throughout the condensation zone and a theoretical calculation using the classical nucleation rate expression due to Volmer and a droplet growth law due to Gyarmathy. Author (GRA)

N77-24448# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

GAS BREAKDOWN CALCULATION: A COMPARATIVE STUDY M.S. Thesis

David A. Kloc Dec. 1976 94 p refs
(AD-A034034; GEP/PH/76-7) Avail: NTIS HC A05/MF A01 CSCL 20/4

An attempt is made to develop a simple yet accurate gas breakdown model which can be easily coupled to the hydrodynamic equations governing fluid flow in laser-target interactions. The accuracy of three relatively simple models is investigated. Each is compared with the more accurate and complex quantum kinetic model. A gas consisting of a single monatomic species is assumed and attention is restricted to the early portion of the electron cascade. A temperature model is found to agree reasonably well with the quantum kinetic model at values of incident laser flux greater than 5 x 10 to the 9th power W/sq cm. A diffusion model is found to yield similar results. A two-temperature model, which is derived in an attempt to extend the range of the temperature model to lower values of incident flux, is found to be invalid. Author (GRA)

N77-24449# Aeronautical Research Inst. of Sweden, Stockholm. Dept. of Aerodynamics.

INVISCID THEORY OF WALL INTERFERENCE IN SLOTTED TEST SECTIONS Interim Report

Sune B. Berndt (Royal Inst. of Technol., Stockholm) Oct. 1976 15 p refs
(Grant AF-AFOSR-2184-72; AF Proj. 9781)
(AD-A034094; AFOSR-76-1458TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

The classical theory of longitudinally slotted walls, which substitutes an approximate homogeneous wall boundary condition for the true mixed conditions, is extended in several respects. Based on recent experimental findings at the FFA, an inviscid flow model is adopted in which the outgoing slot flow penetrates into the plenum chamber as thin jet, while the re-entering flow, admitting quiescent air from the plenum chamber into the test section, induces a longitudinal separation bubble at plenum pressure along the slot and adjacent parts of the test section wall. The three-dimensional analysis, based on the assumption that the slots are narrow, retains quadratic cross-flow terms in the pressure equation and allows the slots to be few in number and have non-uniform distribution and geometry. A family of homogeneous boundary conditions is obtained, each of successively higher accuracy. Application to the design of interference-free transonic test sections is discussed. Unsteady effects are also considered. Author (GRA)

N77-24450# AiResearch Mfg. Co., Phoenix, Ariz.

A NUMERICAL METHOD FOR HIGH REYNOLDS NUMBER VISCOUS SEPARATED FLOW

Paul R. Dodge and L. S. Lieber 30 Sep. 1976 55 p refs
(Contract N00014-74-C-0317; NR Proj. 061-221)
(AD-A034020; AiResearch-74-211196(6)) Avail: NTIS HC A04/MF A01 CSCL 20/4

The Navier-Stokes equation is solved by a single-pass marching process, which overcomes the mathematical difficulties imposed, by transforming the solution in the direction normal to the flow into a spectral plane. The method has been verified, as far as possible. However, a precise determination of accuracy is clouded by the uncertainties introduced by turbulence and the modeling thereof. Nevertheless, it has been shown that the method yields reasonable results both in a full solution to the flow around a shaped body, and in a variety of plate flows with and without pressure gradients. GRA

N77-24451# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.

CONVEX CHUTES IN CONVERGING SUPERCRITICAL FLOW Final Report, Oct. 1972 - Jun. 1976

Frank M. Neilson Sep. 1976 45 p refs
(AD-A033733; WES-MP-H-76-19) Avail: NTIS HC A03/MF A01 CSCL 20/4

This study contains a brief literature survey and limited experimental data regarding the water-surface contours for supercritical flow in a steep converging chute. Items relevant to design of the chute sidewalls are described, and the development of a computer model for chute design is suggested. The author also suggests that a horizontal transverse water surface cannot be obtained unless parallel sidewalls are used and that for a converging chute, the designer will probably have to evaluate and accept some level of nonuniformity in the flow.
Author (GRA)

N77-24452# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

ANALYTICAL INVESTIGATION OF MULTINOZZLE PLUME FLOW FIELDS: FLOW STRUCTURE AND COMPUTATION Interim Report, 1 Oct. 1975 - 31 Sep. 1976

Stanley Rudman 1976 25 p refs
(Contract F44620-76-C-0021)
(AD-A034017; AFOSR-76-1413TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

Progress on the research effort is summarized. Major achievements include: (1) the qualitative understanding of the complex shock structure impingement of two underexpanded rocket plumes and (2) the development of three dimensional computational techniques. A three dimensional isentropic inviscid supersonic computer code is operational and the core flow field of rectangular nozzles has been computed. Advanced techniques built around floating discrete discontinuity surfaces and singularity cells are being incorporated into this program for the computation of the impingement of two rectangular plumes. GRA

N77-24453# Naval Ship Research and Development Center, Bethesda, Md.

FINITE ELEMENT SOLUTION OF FLUID-STRUCTURE INTERACTION PROBLEMS Final Report

Erwin A. Schroeder and Melvyn S. Marcus Oct. 1976 25 p refs Presented at 46th Shock and Vibration Symp., San Diego, Oct. 1975
(AD-A034163; DTNSRDC-76-0145) Avail: NTIS HC A02/MF A01 CSCL 20/4

A finite element method for computing natural frequencies of a submerged structure is implemented using a structural analysis program to solve a sample problem. In this method, the structure and the surrounding fluid are represented by finite elements. Finite element solutions of the sample problem compare well with an analytic solution for both consistent and lumped formulations of the fluid-structure interaction effects.
Author (GRA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-24454* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

METHOD FOR MAKING A HOT WIRE ANEMOMETER AND PRODUCT THEREOF Patent

Volker Milkulla, inventor (to NASA) (NAS-NRC) Issued 24 May 1977 6 p Filed 10 Nov. 1975 Supersedes N76-13455 (14 - 04, p 0453) Sponsored by NASA
(NASA-Case-ARC-10900-1; US-Patent-4,025,891; US-Patent-Appl-SN-630579; US-Patent-Class-338-28; US-Patent-Class-338-229) Avail: US Patent Office CSCL 14B

A hot wire anemometer probe is described that includes a ceramic body supporting two conductive rods parallel to each other. The body has a narrow edge surface from which the rods protrude. A probe wire is welded to the rods and extends along the edge surface. A ceramic adhesive is used to secure the probe wire to the surface so that the probe wire is rigid. A method for fabricating the probe is also described in which the body is molded and precisely shaped by machining techniques before the probe wires are installed. Official Gazette of the U.S. Patent Office

N77-24455* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
METHOD FOR FABRICATING A MASS SPECTROMETER INLET LEAK Patent
Robert F. Harris, inventor (to NASA) Issued 24 May 1977 5 p Filed 26 Nov. 1975 Supersedes N76-13465 (14 - 04, p 0454)
(NASA-Case-GSC-12077-1; US-Patent-4,025,327; US-Patent-Appl-SN-635519; US-Patent-Class-6554; US-Patent-Class-65-59A; US-Patent-Class-6564; US-Patent-Class-65-108) Avail: US Patent Office CSCL 14B

A method of fabricating an inlet leak for measuring chemically reactive gases is proposed. The method involves the steps of preparing a selected internal surface of a high melting point metal tubing for sealing to a glass tubing. A portion of the glass tubing is inserted into the prepared portion of the metal tubing, the glass tubing having an outer diameter substantially the same as the inner diameter of the metal tubing. The inserted glass tubing is sealed to the internal surface of the metal tubing; the glass tubing is drawn under a magnifying device to reduce the entire interior diameter thereof to substantially two microns; and an end portion of the drawing glass tubing is broken away. Official Gazette of the U.S. Patent Office

N77-24456*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SELECTIVE IMAGE AREA CONTROL OF X-RAY FILM EXPOSURE DENSITY Patent Application
C. Martin Berdahl, inventor (to NASA) (JPL) Filed 9 Apr. 1976 9 p
(Contract NAS7-100)
(NASA-Case-NPO-13808-1; US-Patent-Appl-SN-675328) Avail: NTIS HC A02/MF A01 CSCL 14B

The light received from an X-ray image intensifier is applied to a beam splitting mirror which divides the light between a motion picture film camera and a television film camera. Between the beam splitter and the motion picture film camera, there is positioned another light beam splitter to direct some of the light at a mask having an opening which encloses only the image area of interest. Behind that opening, there is positioned a photomultiplier intensity sensor for determining the exposure required and varying X-ray beam intensity. NASA

N77-24457*# Radiometric Technology, Inc., Wakefield, Mass.
MICROWAVE RADIOMETER FOR SUBSURFACE TEMPERATURE MEASUREMENT Final Report
Ronald A. Porter and Kenneth P. Bechis 1 May 1976 53 p ref
(Contract NAS2-8337)
(NASA-CR-137827) Avail: NTIS HC A04/MF A01 CSCL 14B

A UHF radiometer, operating at a frequency of 800 MHz, was modified to provide an integral, three frequency voltage standing wave ratio (VSWR) circuit in the radio frequency (RF) head. The VSWR circuit provides readings of power transmission at the antenna-material interface with an accuracy of plus or minus 5 percent. The power transmission readings are numerically equal to the emissivity of the material under observation. Knowledge of material emissivity is useful in the interpretation of subsurface apparent temperatures obtained on phantom models of biological tissue. The emissivities of phantom models consisting of lean beefsteak were found to lie in the range 0.623 to 0.779, depending on moisture content. Radiometric measurements performed on instrumented phantoms showed that the radiometer was capable of sensing small temperature changes occurring at depths of at least 19 to 30 mm. This is consistent with previously generated data which showed that the radiometer could sense temperatures at a depth of 38 mm. Author

N77-24458# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
METHODS FOR FLOW VISUALIZATION USING OPTICALLY ACTIVATED TRACERS M.S. Thesis - Goettingen Univ., West Ger. [METHODEN ZUR SICHTBARMACHUNG VON STROEMUNGEN MITTELS OPTISCH AKTIVIERTER TRACER]
V. Delitzsch Oct. 1976 58 p refs In GERMAN
(MPIS-24/1976) Avail: NTIS HC A04/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 13,05

Two methods for flow visualization, allowing probeless marking and observation of liquid flow, are described. Both methods are based on the optical activation of tracers (suspended particles or liquid elements), using either UV laser pulses along a straight line and an electronic camera, or a continuously radiating light source causing particle phosphorescence. An electronic time marking device permits exact determination of development of the flow in time. Both methods were tested for unsteady flow occurring in a liquid-filled cylindrical container after sudden interruption of a constant rotation around its axis. ESA

N77-24459# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
FREQUENCY DOMAIN IDENTIFICATION OF GYRO DRIFT COEFFICIENTS
R. E. Pugh and J. C. Hung (Tenn. Univ., Knoxville) 30 Aug. 1976 28 p refs
(DA Proj. 1X3-64307-D-212)
(AD-A033688; RG-TT-6) Avail: NTIS HC A03/MF A01 CSCL 17/7

This report presents a new two-axis tumble test for the determination of gyro drift parameters. The method uses the concept of frequency domain data reduction which helps to lessen the required test procedure and the needed test equipment. Both the test procedure and data processing algorithm are presented in detail. The result of a simulated testing is included to demonstrate the proposed concept. Author (GRA)

N77-24460# Stanford Research Inst., Menlo Park, Calif.
INTERACTIVE AIDS FOR CARTOGRAPHY AND PHOTO INTERPRETATION Semiannual Technical Report, 12 May - 12 Nov. 1976
Harry G. Barrow Nov. 1976 52 p refs
(Contract DAAG29-76-C-0057; ARPA Order 2894)
(AD-A033727) Avail: NTIS HC A03/MF A01 CSCL 14/5

This report describes the work performed during the first six months of our project on Image Understanding. The central scientific goal of the research program is to investigate and develop ways in which diverse sources of knowledge may be brought to bear on the problem of interpreting images. The research is focused on the specific problems entailed in interpreting aerial photographs for cartographic or intelligence purposes, with a view to the eventual development of a collaborative aid to the cartographer or photo interpreter. A key concept is the use of a generalized digital map to guide the process of image interpretation. Author (GRA)

N77-24461# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
PHOTOMACROGRAPHY OF ARTIFACTS IN TRANSPARENT MATERIALS
Stephen J. Marshall Nov. 1976 39 p refs
(DA Proj. 1F1-61102-B-52A)
(AD-A033670; CRREL-76-40) Avail: NTIS HC A03/MF A01 CSCL 14/5

Several original methods were developed to photograph artifacts in transparent materials such as ice. The artifacts, occurring in the surface, bulk, and interface, were generally 0.01 mm to 70 mm in size. Sample preparation, illumination, focusing and other technical problems are discussed in detail. Several sample photographs are included. Author (GRA)

N77-24462# Air Force Academy, Colo.
OPTIMUM DESIGN OF AN INTENSITY LIMITED PINHOLE-

SCINTILLATOR, IMAGE CONVERTER CAMERA MODEL FOR SIMULTANEOUS ENERGY, SPATIAL, AND TIME RESOLUTION OF SOFT X-RAYS Final Report, 15 Apr. 1975 - 30 Jun. 1976
Robert A. Nuttelman 30 Aug. 1976 32 p refs
(AD-A034405; FJSRL-TR-76-0012) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report describes the optimum design of a generalized pinhole-scintillator, image converter camera model offering simultaneous energy, spatial, and time resolution of soft X-rays. This type of diagnostic system is particularly suited to analysis of X-rays from intense plasma discharge sources such as plasma focus and electromagnetic implosion devices having emitting dimensions in the mm to cm range and pulse lengths of 10 -1000 nsec. The usual diffraction limited, optimum pinhole design for spatial resolution is not used since sufficient X-ray intensities are often not available from laboratory plasmas to take advantage of optimum pinhole resolution. Instead, the condition for obtaining optimum spatial resolution for the intensity limited case for given time and energy resolution requirements are derived. The controlling requirement of film exposure is satisfied. Graphical solutions of optimum pinhole-to-scintillator distance, optimum pinhole diameter, and spatial resolution at optimum conditions are presented as a function of a dimensionless exposure parameter beta for several values of plasma-to-pinhole distance. This form of solution presentation allows rapid analysis of the effects of equipment changes and different degrees of time and energy resolution upon optimum spatial resolution.
Author (GRA)

N77-24463# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PERFORMANCE AND EVALUATION OF AN X HOT WIRE SENSOR IN A TWO-DIMENSIONAL FREE JET IN THE PRESENCE OF CROSS FLOW COMPONENT M.S. Thesis
Fazal B. Kauser Dec. 1976 212 p refs
(AD-A034271; GAE/AE/76D-4) Avail: NTIS HC A10/MF A01 CSCL 20/4

This thesis reports the results of an experimental investigation of rotation tests conducted with two X wire sensor arrangements in the potentical core of a free jet and the influence of small temperature variations on the linearized response of a hot wire sensor. The tests were performed in the free jet issuing from a 10 cm x 1 cm nozzle having turbulence intensity of 0.3% at the exit plane. The two X wire sensors used were TSI Models 1240 and 1241. Each sensor arrangement consisted of two platinum coated, tungsten wires, having 3.81 micron diameter, active sensor length 1.25 mm and separated by 1 mm. The tests were conducted at Reynolds Numbers of 7.2, 14.54 and 21.8, based upon wire diameter. Investigation showed that both X sensors had a strong preference for the direction of mean motion, and the error due to misalignment in yaw was largest at very small misalignment angles. The Model 1240 showed insensitivity to misalignment in pitch in the upper range of Reynolds number, but Model 1241 was highly sensitive to misalignment in pitch. In the second part of the study, air temperature was increased from 4 F to 20 F above the reference, and its influence on the linearized response of the upstream sensor of Model 1240 was observed. Test results showed a strong influence of the variations in air temperature on the linearized sensor response at velocities below approximately 100 ft/sec. GRA

N77-24464# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYSIS OF A SEMICONDUCTOR DETECTION SYSTEM FOR MEASURING RADIOACTIVE NOBLE GASES M.S. Thesis
Kenneth K. Hunt Dec. 1976 65 p refs
(AD-A034280; GNE/PH/76D-4) Avail: NTIS HC A04/MF A01 CSCL 18/8

A cryogenically-cooled detection system employing two lithium-drifted silicon detectors to detect small activities of radioactive noble gases is evaluated. The detectors face a sample chamber with beryllium windows. The top window is thin to allow detection of most electrons and electromagnetic radiation by the upper detector. The lower window is thicker to allow only electromagnetic radiation to enter the lower detector. Electron, X-ray, and coincidence spectra analyses are considered, and the results are compared to gamma-ray spectrum analysis with a lithium-drifted germanium detector. A computer method to generate hypothetical spectra is used to give theoretical system results. GRA

N77-24465# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.
PIEZOELECTRIC POLYMER TRANSDUCERS FOR DYNAMIC PRESSURE MEASUREMENTS Final Report
Aime S. DeReggi, Seymour Edelman, and Steven C. Roth Jun. 1976 42 p refs Sponsored in part by the Natl. Highway Traffic Safety Admin.
(PB-264125/6; NBSIR-76-1078) Avail: NTIS HC A03/MF A01 CSCL 13L

The construction, testing and calibration of piezoelectric polymer sensing transducers are described. The piezoelectric material was obtained by poling 25 micrometer thick, polyvinylidene fluoride sheet. Sensors with an active area of 1 cm diameter, intended for dynamic interface pressure measurements, were calibrated in a fixture generating normal pressure transients by means of piston impact. Sensors with an active area of 2 mm diameter, intended for measuring dynamic pressures while implanted in the cranium of rhesus monkeys, were calibrated in an oil cell with a piston cylinder seal which provided hydraulic pressure transients by means of impact on the piston. The larger sensors had a normal pressure sensitivity around 3 microvolts/Pa (20 mV/psi) and the smaller sensors had a hydraulic pressure sensitivity around 0.7 microvolts/Pa (5 mV/psi). GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-24466*# Scientific Translation Service, Santa Barbara, Calif.
HIGH PRECISION GRATINGS PRODUCED WITH LASER-LIGHT AND PHOTORESIST LAYERS
D. Rudolph and G. Schmahl Washington NASA May 1977 19 p refs Transl. into ENGLISH from Optik-30 (West Ger.) v. 5, 1970 p 475-487
(Contract NASw-2791)
(NASA-TT-F-16777) Avail: NTIS HC A02/MF A01 CSCL 20E

A method is described to make high precision gratings with laserlight and photoresist. The accuracy of such systems is discussed. Blazed diffraction gratings up to a ruled area of about 100 x 100 square millimeter with more than 90 percent resolution and 50 percent efficiency have been produced. Such gratings have low straylight and are completely ghost-free. With this method one can make very large gratings which are needed for large telescopes. Author

N77-24467*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIABLE VOLUME MASER TECHNIQUES
Victor S. Reinhardt Apr. 1977 18 p refs Presented at 8th Ann. NASA/DOD PTTI Conf., Washington, D. C., 30 Nov. - 2 Dec. 1976
(NASA-TM-X-71316; X-814-77-80) Avail: NTIS HC A02/MF A01 CSCL 20E

The frequency stability of hydrogen masers in variable volume storage bulbs is discussed in terms of wall shift. Variable volume devices discussed include: Brenner flexible bulb, Debely device, and the concertina hydrogen maser. A flexible cone variable volume element outside the cavity is described. F.O.S.

N77-24468*# National Aeronautics and Space Administration. Pasadena Office, Calif.
STABILIZATION OF He2(a-3 SIGMAu(+)) MOLECULES IN LIQUID HELIUM BY OPTICAL PUMPING FOR VACUUM UV LASER Patent Application
Jonas S. Zmuidzinas, inventor (to NASA) (JPL) Filed 29 Mar. 1977 13 p
(Contract NAS7-100)
(NASA-Case-NPO-13993-1; US-Patent-Appl-SN-782463) Avail: NTIS HC A02/MF A01 CSCL 20E

A technique is disclosed for achieving large populations of metastable spin-aligned He2 molecules in superfluid helium to obtain lasing in the vacuum ultraviolet wavelength regime around 0.0800 mu meter by electronically exciting liquid (superfluid) helium with a comparatively low-current electron beam and spin aligning the metastable molecules by means of optical pumping with a modestly-powered circularly-polarized CW (continuous wave) laser. Once a high concentration of spin-aligned He2 is achieved with lifetimes of a few milliseconds, a strong microwave signal destroys the spin alignment and induces a quick collisional transition of He2 molecules to a lasing transition. NASA

N77-24469*# National Aeronautics and Space Administration. Pasadena Office, Calif.

DOUBLE DISCHARGE METAL VAPOR LASER WITH METAL HALIDE AS A LASANT Patent Application

Gary R. Russell (JPL), Che-Jen Chen (JPL), and Noble M. Nerheim, inventors (to NASA) (JPL) Filed 21 Apr. 1977 10 p
(Contract NAS7-100)
(NASA-Case-NPO-13448-2; US-Patent-Appl-SN-789760) Avail: NTIS HC A02/MF A01 CSCL 20E

A double discharge metal vapor laser in which a metal halide is used as the lasant, is described. The laser includes a heated discharge tube within which a metal halide is contained. The discharge tube is provided with a pair of electrodes for producing electrical discharges. The ends of the tube are closed with a pair of Brewster windows outside of which are positioned a pair of suitable mirrors. Heating of the discharge tube and the metal halide produces a metal halide vapor. An electrical discharge causes dissociation of the metal halide vapor to produce metal atoms. After a predetermined time delay to permit metastable relaxation of the metal atoms, a second electrical discharge acts as a pumping pulse to produce a population inversion and lasing. NASA

N77-24470# Sandia Labs., Albuquerque, N. Mex. Chemical Physics Div.

A 3 PERCENT EFFICIENT O(1S) LASER AT 5577 ANGSTROMS PHOTOLYTICALLY PUMPED BY NeF: A PROPOSAL

A. Kay Hays Sep. 1976 13 p refs
(SAND-76-0447) Avail: NTIS HC A02/MF A01

A method is described for producing a 3 percent efficient O(S-1) laser at 5577 A. A proof of principle experiment that would produce a 2 percent efficient O(A-1) laser is proposed. ERA

N77-24471# California Univ., Livermore. Lawrence Livermore Lab.

SUB-NANOSECOND PLASTIC SCINTILLATOR TIME RESPONSE STUDIES USING LASER PRODUCED X-RAY PULSED EXCITATION

K. G. Tirsell, G. R. Tripp, E. M. Lent, R. A. Lerche, J. C. Cheng, L. Hocker (EG and G, Inc.), and P. B. Lyons (Los Alamos Scientific Lab.) 17 Nov. 1976 6 p refs Presented at the IEEE Transactions Nuclear Sci. Symp., New Orleans, 11 Oct. 1976
(Contract W-7405-eng-48)
(UCRL-78835; Conf-761006-17) Avail: NTIS HC A02/MF A01

The light emission time response of quenched NEIII plastic scintillators was measured using a streak camera (20 ps resolution) and 100 to 180 ps, 1.06 micrometers, laser-produced, pulsed, low energy X-ray excitation. Each light output pulse was obtained by deconvolution from the film data using the X-ray temporal response measured with an X-ray sensitive streak camera (10 ps resolution). Time response parameters are presented for benzophenone and acetophenone, quenching agents which most effectively reduce the decay time of the singlet component. Full width-half-maximum less than or equal to 260 ps were observed for NEIII samples quenched with greater than or equal to 2 percent benzophenone. Results are given for unquenched samples consisting of different concentrations of butyl-PBD in PVT and for the phosphor ZnO doped with Ga. ERA

N77-24472# California Univ., Livermore. Lawrence Livermore Lab.

X-RAY/GAMMA RAY LASER PROJECT Semiannual Progress Report, 15 Nov. 1974 - 15 Aug. 1975

8 Jan. 1976 89 p refs
(Contract W-7405-eng-48)
(UCRL-51823-75) Avail: NTIS HC A05/MF A01

Progress in computer simulation of X-ray laser conditions and in the actual design of a soft X-ray laser is reported. ERA

N77-24473# Illinois Univ., Urbana. Gaseous Electronics Lab.

PUMPING MECHANISM FOR THE NEON-NITROGEN NUCLEAR EXCITED LASER

G. W. Cooper, J. T. Verdeyen, W. E. Wells, and G. H. Miley 1976 5 p refs Presented at the Princeton Univ. Conf. on Partially Ionized Plasmas, Princeton, New Jersey, Jun. 1976
(Contract E(11-1)-2007)
(COO-2007-81; Conf-760683-2) Avail: NTIS HC A02/MF A01

Lasing was observed on two transitions of atomic N, the 3p2P30 yields 3s2P3 (8629.24 A) and the 3p2D50 yields 3s2P3 (9392.79 A). The Ne-N2 system also lases in an afterglow of an electrical discharge, which has similar characteristics to a nuclear radiation generated plasma. In order to determine the physical processes for pumping this laser, a detailed study of the afterglow system was performed. The pumping mechanism was found to be collisional-radiative electron-ion recombination. Microwave quenching of both the laser and spontaneous afterglow light shows conclusively that a recombination process directly produces a nitrogen atom in either the upper laser level or, more likely, in a higher lying energy level which rapidly de-excites to the upper laser level. Studies of the temperature dependence of the recombination coefficient indicate a collisional-radiative process allowing the recombining ion to be tentatively identified as N(+). ERA

N77-24474# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

LOW FREQUENCY PARAMETRIC AMPLIFIER [AMPLIFICATORE PARAMETRICO A BASSA FREQUENZA]

P. Bonifazi and F. Bordoni May 1976 50 p refs In ITALIAN (LPS-76-16) Avail: NTIS HC A03/MF A01

A low frequency, low noise amplifier is described that has two modes of operation: frequency conversion type and negative resistance type, and uses a parametric subharmonic oscillator. The amplifier is planned for a high sensitivity gravitational wave experiment, operating at liquid helium temperature. The first experimental results are reported, and possible prospects for further development are indicated. ESA

N77-24475# Boeing Aerospace Co., Seattle, Wash.

LASER BEAM TARGET INTERACTION. VOLUME 1: A 2.8 MICRONS WAVELENGTH Final Report, 31 Mar. 1974 - 15 Jan. 1976

R. B. Hall, W. E. Maher, J. D. McClure, D. B. Nichols, and C. R. Pond Jul. 1976 115 p refs 2 Vol.
(Contract F29601-73-A-0038; ARPA Order 1905)
(AD-A032453; D180-19256-1-Vol-1; AFWL-TR-75-342-Vol-1)
Avail: NTIS HC A06/MF A01 CSCL 20/6

This report is the first of two volumes on the subject of laser beam target interaction. Laser beam-target interactions for solid surfaces have been investigated at 2.8 microns wavelength with a 150 J photoinitiated pulsed HF chemical laser. Laser-supported detonation wave propagation was studied at beam intensities up to 160 MW/sq cm. Information about target plasmas was obtained by means of spectroscopic and interferometric diagnostics. Ignition thresholds for laser-supported absorption waves were measured both by observation of plasma luminosity and by measuring the laser power transmitted through a small hole in the target. Measurements were made of thermal and impulse coupling occurring under plasma ignition conditions. Author (GRA)

N77-24476# Boeing Aerospace Co., Seattle, Wash.

LASER BEAM TARGET INTERACTION. VOLUME 2: LASER EFFECTS AT 10.6 MICRONS Final Report, 31 Mar. 1974 - 15 Jan. 1976

R. B. Hall, W. E. Maher, and P. S. P. Wei Jul. 1976 77 p refs 2 Vol.
(Contract F29601-73-A-0038; ARPA Order 1905)
(AD-A032454; D180-19256-2-Vol-2; AFWL-TR-75-342-Vol-2)
Avail: NTIS HC A05/MF A01 CSCL 20/6

This report is the second of two volumes on the subject of laser beam target interaction. Volume I considered both the performance and design of a pulsed chemical laser and the laser effects measurements made with that laser. This volume describes both impulse and thermal coupling measurements made at 10.6 microns wavelength. The laser used was the Boeing double-pulse Marx Bank laser which can emit two 15 joule pulses with any desired pulse separation (from simultaneous to several seconds). Spectroscopic measurements were used to determine some of the basic properties of laser-supported absorption waves. In addition, however, a limited amount of data was gathered in order to determine the threshold intensity for igniting laser-supported absorption (LSA) waves from magnesium. The main goal of the work reported here was to determine impulse coupling and thermal coupling at high intensities. One of the most important results was to determine the spatial dependence of absorbed energy on a target at high laser intensities. Author (GRA)

N77-24477# Naval Training Equipment Center, Orlando, Fla. Electronics and Acoustic Lab.

LASER PLOTTING PROJECTOR Final Report, Jun. 1974 - Jun. 1975

Herbert Berke Nov. 1976 51 p refs

(AD-A032576; NAVTRAEQUIPC-IH-249) Avail: NTIS HC A04/MF A01 CSCL 20/5

This report has been compiled to provide a means of obtaining a wide-angle, large screen, laser display for training purposes. Visits were conducted to various Government facilities to investigate present display techniques, and a search analysis was performed to determine the past and present studies that had been done on this subject. The advantages and disadvantages of each part of the display system were researched, and a conceptual design was initiated based on the gathered data. The Appendix included in this report gives a brief summary of work that has been performed by the various Government facilities. Author (GRA)

N77-24478# Arkansas Univ., Fayetteville. Dept. of Electrical Engineering.

LASER RESONATOR STUDIES Final Report

M. M. Johnson, L. G. Collier, and G. E. Smith Dec. 1976 186 p refs

(Contract F29601-74-C-0077)

(AD-A034079; AFWL-TR-75-333) Avail: NTIS HC A09/MF A01 CSCL 20/5

The goal of the study was to find a hole-coupled resonator with good azimuthal mode discrimination for potential uses in high power laser applications. Two computer programs were developed to aid in the analysis of hole-coupled resonators. The first program calculates the scalar eigenmodes of circular cylindrical resonators with exp (plus or minus jl times phi) where l is an integer azimuthal variaton and arbitrary radical mirror figure. Graphs of the radial mode eigenvalues (versus Fresnel number) for the four lowest order azimuthal modes revealed that typically, the larger the hole becomes in a hole-coupled resonator, the higher the azimuthal index of the dominant (lowest loss) mode (media gain saturation not included). The lowest order azimuthal mode losses were almost identical in one negative branch toroidal hole-coupled resonator and in a positive branch resonator where both mirrors had on-axis holes. The second computer program calculates the radial mirror profiles by a non-linear multiple regression technique such that the eigenmode magnitude and/or phase profiles are best, least squares, fits to use specified radial mode profiles. Tests showed, for example, that a field, uniform magnitude and phase, could be achieved in the hole for l = 0 of a hole-coupled resonator. In most instances however the l = 0 mode was not the dominant arbitrary azimuthal field variation so that best fits to desired azimuthal is designed for the lowest loss mode. Author (GRA)

N77-24479# Stanford Univ., Calif. Edward L. Ginzton Lab.

STUDIES OF TECHNIQUES FOR GENERATION OF VACUUM ULTRAVIOLET AND SOFT X-RAY LASER RADIATION Final Report, 1 Dec. 1974 - 30 Sep. 1976

Dec. 1976 49 p refs

(Contract N00014-75-C-0576)

(AD-A033778; SU-GL-2642) Avail: NTIS HC A03/MF A01 CSCL 20/5

The goal of this program is to develop techniques for the generation of coherent vacuum ultraviolet and soft X-ray radiation. The overall program has two major thrusts. The first is the theoretical and experimental development of a new type of collision process which is felt has particular promise for the development of short wavelength lasers. The second is the extension of a successful nonlinear optical techniques in vapors to shorter wavelengths. In the following sections work under both of these programs will be summarized. GRA

N77-24480# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.

SPECTRA-PHYSICS MODEL 944-1 LASER LEVEL, NOVEMBER 1976

Wesley J. Marshall 24 Jan. 1977 18 p

(AD-A034922; USAEHA-42-0315-77) Avail: NTIS HC A02/MF A01 CSCL 06/18

A laser radiation protection special study was performed on the Model 914-1 Laser Level. The laser was a Class IIIb system when the beam was stationary and such lasers present a momentary viewing hazard to the direct or specularly reflected beam. This laser did not present a hazard when operated in the scanning mode. Author (GRA)

N77-24481# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

ANTIREFLECTION COATINGS FOR CALCIUM FLUORIDE LASER WINDOWS FOR 5.3 MICRONS Final Technical Report, 1 Oct. 1974 - 1 Mar. 1976

Melvin C. Ohmer Sep. 1976 75 p refs

(AD-A033103; AFML-TR-76-103) Avail: NTIS HC A04/MF A01 CSCL 20/5

Four distinct antireflection (AR) coatings and half-wave coatings of their constituent coating materials were evaluated for 5.3 microns on CaF2 and BaF2 substrates. The coating materials were lead and strontium fluoride, thorium tetrafluoride, and zirconium dioxide. The coatings were evaluated with regard to absorption, peak transmission, bandwidth, residual strain, and adhesion. A PbF2/ThF4 AR design had an absorption per surface less than .05 percent. The absorption of ZrO2 is excessive at 5.3. All AR designs passed the scotch tape adhesion test. The index of SrF2 in thin film form is lower than the bulk value. In half-wave coatings of SrF2 an index as low as 1.22 was observed. Bandwidths of three AR designs were 0.5 microns or greater. Absorptions of half-wave coatings at 1.06 and 3.8 microns indicate that further development will be required for these wavelengths. Absorption measurements for the PbF2/ThF4 design for CaF2 windows coated on both sides are reported for 5.3, 3.8, and 2.8 microns. The windows absorbed 0.04 percent, 0.2 percent, and 0.5 percent, respectively. Some designs were plaqued with stress induced birefringence in the visible which did not adversely affect the transmission in the IR. The PbF2, ThF4, and ZrO2 coatings did not show residual strain. The absorption measurements obtained on three different calorimeters are compared. GRA

N77-24482# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE GEOMETRIC THEORY OF ROOF REFLECTOR RESONATORS M.S. Thesis

Howard Elmus Evans, II Dec. 1976 135 p refs

(AD-A034283; GEP/PH/76-3) Avail: NTIS HC A07/MF A01 CSCL 20/5

Laser resonators using roof reflectors with 90 deg - alpha roof angles (alpha small and positive) are analyzed geometrically when the roof edges at opposite ends of the resonator are aligned either parallel or perpendicular (crossed). Stability conditions, involving reflector dimensions, are found which specify a maximum axis length for the existence of stable rays. In the parallel-roof case, stable rays are shown to be ring-type, making any given number of round-trips before spatially repeating. Stable rays in the crossed-roof case are superpositions of two parallel-roof ray patterns in orthogonal planes. For any pattern, the reflector roof edges are shown to be geometrically excluded when the axis length is greater than one-half the maximum length for that pattern. It is then predicted that when the roof edges are excluded, the resonant modes are pure Gaussian. Author (GRA)

N77-24483# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYSIS OF THE SUN PUMPED LASER CONE OPTICS M.S. Thesis
Perry Michael Towles Sep. 1976 60 p refs
(AD-A034284; GEP/PH/76-11) Avail: NTIS HC A04/MF A01 CSCL 20/5

A meridional ray analysis is accomplished on the solar energy collector part of a sun pumped laser. A Gaussian approximation is completed and shows a solar image 0.57 inches in diameter is located 3.81 cm from the end of the laser rod. The image is inside the laser cavity. For 200 watts available at the primary mirror of the Cassegrainian System, it is found that only about 150 watts is furnished to the cone lens for through put. Only about 66 percent of the available 150 watts is collected by the cone lens and channelled to the laser rod by the condensing cone. The last is found by a skew ray analysis of some rays coming from the outer radial part of the primary mirror. These rays are traversing the system all the way to the cone lens, but are diverging before entering the lens and therefore not being collected by the condenser cone. An analysis is made of the exit angle of the power traversing the condenser cone. The analysis was made so that an AR coating of the appropriate material and thickness could be put on the laser rod for maximum collection of the solar energy wavelengths used in pumping the Nd:YAG laser rod. GRA

N77-24484# Avco-Everett Research Lab., Everett, Mass.
DESIGN AND DEVELOPMENT OF SOFT X-RAY LASER Semiannual Technical Report, Mar. - Dec. 1976
H. W. Friedman Dec. 1976 57 p refs
(Contract N00173-76-C-0214; ARPA Order 2694)
(AD-A034326) Avail: NTIS HC A04/MF A01 CSCL 20/5

Progress in the theoretical and experimental effort of the soft X-ray laser work is outlined. The lithium vapor model has been refined to include the effects of autoionization and the stimulated Raman gain of the laser system has been correctly calculated. A single order pulse from the mode locked train of CO2 pulses has been isolated and is ready to be injected into the 'Big Bang' laser for amplification. The experimental chamber, a vacuum system and focusing optics is complete and the grazing incidence spectrometer is assembled. A dye laser system tuned to 9584 A has been built and tested. GRA

N77-24485# Materials Research Labs., Maribyrnong (Australia).
INTERACTION OF PULSED CO2-GASER RADIATION WITH NON-METALS
D. R. Brighton and W. E. K. Gibbs Jun. 1976 39 p refs
(AD-A034410; MRL-R-663) Avail: NTIS HC A03/MF A01 CSCL 11/2

Samples of crown glass, fused silica, Perspex and Irtran 1 were irradiated with 0.2-microsec duration pulses from a CO2 laser, at energy densities of between 10 and 800 kJ/sq m. The damage induced was thermal in origin and was controlled more by the absorption depth in the material than by thermal diffusion. The major damage mechanisms were cracking and flaking in the case of crown glass, and vaporisation in the cases of fused silica and Perspex. Irtran 1 was the most difficult to damage because of its comparatively large absorption depth. Impulse production was studied, and was explained by simple models involving vaporisation and the excitation of laser-supported waves. Author (GRA)

N77-24486# Nevada Univ., Reno. Dept. of Chemistry.
MOLECULAR ENERGY TRANSFER BY COLLISIONAL PROCESSES CHARACTERISTIC OF GAS LASERS Final Report, 1 Jan. 1972 - 31 Dec. 1976
Hyung Kyu Shin 1 Jan. 1977 14 p refs
(Grant AF-AFOSR-2231-72; AF Proj. 6813; AF Proj. 9538)
(AD-A034912; AFOSR-77-0001TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The major objective of this project was to develop theoretical models for the calculation of transition probabilities in collisions of atoms and molecules. New methods have been developed, and existing techniques have been refined to provide both a quantitative and a qualitative interpretation of the mechanisms and dynamics of molecular collisions. Special emphasis is given to the problem of deriving explicit expressions for energy transfer probabilities, so their dependence on pertinent collision parameters can be readily determined. Whenever possible, the theoretical study has been tested against experimental data, not only for demonstrating the utility of the theoretical formulation for the prediction and correlation of experimental results, but also for explaining the observations and using the discrepancies between theory and experiment to further refine our understanding of energy transfer processes. The most important investigation carried out during the tenure of this grant has dealt with the vibrational energy transfer processes in hydrogen fluoride molecules, which play major roles in chemical laser operation. In addition, the following aspects of molecular collisions have also been investigated: vibration-rotation energy transfer in H2O and NH3, near-resonant vibration-vibration energy transfer in N2-CO, intramolecular vibration-rotation energy transfer in HF-Ar, simultaneous vibrational and rotational transitions in H2 + Ar, semiclassical approach to vibrational energy transfer in H2 + He, and translational energy dependence of the reaction cross sections of alkali-methyl iodide reactions. GRA

N77-24487# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTS OF OXYGEN CONTAMINATION ON GAS DYNAMIC LASER PERFORMANCE M.S. Thesis
John B. Watterson Dec. 1976 107 p refs
(AD-A034900; GEP/PH/76D-12) Avail: NTIS HC A06/MF A01 CSCL 20/5

The effects of oxygen in the fuel of a shock-tube driven gas dynamic laser were observed with a four-inch shock tube. Five test gases comprised of ten percent CO2, three percent H2O, and varying amounts of N2 and O2 were studied. Nominal stagnation conditions were 2000 K and 500 psia. The small-signal gain coefficient was measured on three different rotational transitions for each test gas, permitting a J-line scan to be performed. The gas temperature, vibrational temperature of the upper laser level, and energy available for lasing were calculated using the J-line scan method. It was found that the small-signal gain coefficient, the vibrational temperature of the upper laser level, and the energy available for lasing all decreased linearly as the oxygen concentration in the gas dynamic laser fuel increased. Specifically, an increase in the oxygen content of 1% resulted in a decrease of the gain coefficient by roughly 1.5%. Such a decrease is in agreement with previous work. GRA

N77-24488# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THERMAL STRESSES AS A LASER HEATING DAMAGE MECHANISM M.S. Thesis
Jan N. Garrison Nov. 1976 159 p refs
(AD-A034877; GAE/MC/75-4) Avail: NTIS HC A08/MF A01 CSCL 20/5

The relative significance of thermal stresses as a laser heating damage mechanism is assessed by comparison with the damage mechanisms of melting and thermal degradation of structural strength properties. The limiting cases of one-dimensional axial and one-dimensional radial heat flux in a thin target plate whose plane is normal to the axis of a stationary, axially symmetric heat source, are investigated. A one-dimensional radial heat conduction numerical model of the linear thermoelastic stress field including the effects of melting and structural failure is developed. Residual tensile strength and damage size are presented as functions of the laser beam and target plate parameters. Author (GRA)

N77-24489# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AIR BREAKDOWN BY PARTICLES IN AN HF LASER BEAM
Donald E. Lencioni, Donald P. DeGloria, and Lee C. Pettingill 28 Oct. 1976 16 p refs
(Contract F19628-76-C-0002; ARPA Order 600)
(AD-A034811; LTP-35; ESD-TR-76-313) Avail: NTIS HC A02/MF A01 CSCL 20/5

Thresholds were measured for air breakdown initiated by particles in a 3.5 microsec, 2.9 micrometers laser beam. The pulsed chemical laser at Boeing Aerospace Corporation was used for these studies. The thresholds for 50 micrometers diameter graphite, NaCl, Al2O3 particles and 10 micrometers and 30 micrometers quartz fibers were found to be factors of three

to five higher than the comparable thresholds for 10.6 micrometers lasers. The material dependence for the threshold was found to differ from that for short pulse 10.6 micrometers breakdown. The radial plasma growth rate was measured and found to be approximately equal to the growth rate at 10.6 micrometers for an intensity of 3 x 10 to the 7th power W/sq. cm.
Author (GRA)

N77-24490# University of Southern Calif., Los Angeles. Div. of Electronic Systems.
X-RAY LASER STUDIES Final Report, 15 Oct. 1975 - 28 Oct. 1976
William H. Louisell and John F. Seely 28 Oct. 1976 10 p refs
(Grant DAAG29-76-G-0076)
(AD-A034771; ARO-13602.6-R-P) Avail: NTIS HC A02/MF A01 CSCL 20/5
Topics of this theoretical study are swept ion beams and quasi-steady-state excitation. A listing of papers in various stages of publication is provided. Author (GRA)

N77-24491# Naval Research Lab., Washington, D. C. Plasma Dynamics Div.
EFFICIENT LASER LIGHT ABSORPTION BY ION ACOUSTIC FLUCTUATIONS Interim Report
W. M. Manheimer, D. G. Colombant, and B. H. Ripin Dec. 1976 16 p refs
(NRL Proj. H02-51; RR0110941)
(AD-A034450; NRL-MR-3426) Avail: NTIS HC A02/MF A01 CSCL 20/5
A new efficient absorption mechanism for intense laser light in plasma resulting from an ion acoustic instability generated by a return current is described. Comparisons with experimental results are presented. Author (GRA)

N77-24492# ARO, Inc., Arnold Air Force Station, Tenn.
THE DEVELOPMENT OF A DISPLACEMENT INTERFEROMETER FOR MODEL DEFLECTION MEASUREMENTS Final Report, Jul. 1974 - Jul. 1976
B. W. Bomar, W. H. Goethert, R. A. Belz, and H. T. Bentley, III AEDC Jan. 1977 58 p refs Sponsored by AF
(ARO Proj. V37A-30A; ARO Proj. B32A-06A)
(AD-A034384; ARO-OMD-TR-76-79; AEDC-TR-76-116) Avail: NTIS HC A04/MF A01 CSCL 14/2
A two-beam laser interferometric device capable of continuously measuring either absolute or differential displacement (both steady state and time variant) with a resolution to one-quarter of the laser wavelength is described. This device is proposed for measurement of model attitude and deflection in wind tunnel applications. Experiments are presented demonstrating its accuracy, versatility, and online readout capabilities. A conceptual multibeam device to extend the present device for simultaneous measurement of pitch, roll, twist, and deflection is also discussed. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-24493 Drexel Univ., Philadelphia, Pa.
A WORKABILITY ANALYSIS OF THE COLD FORGING OF GEARS WITH INTEGRAL TEETH Ph.D. Thesis
Mark Louis Robinson 1976 161 p
Avail: Univ. Microfilms Order No. 77-5230
A method for predicting the likelihood of surface cracking is applied to the types of deformation that would occur during cold forging of a gear. The forging of a gear from a ring preform is simulated by dividing the process into two stages; ring upsetting and gear tooth forging. Using model materials, the workability analysis is applied to both stages to determine the effect of process variables on the likelihood of surface cracking. Preform design guidelines for the successful forging of different types of gears are formulated. A criterion to predict the tendency for the formation of a fold type defect on the bore of an upset ring, i.e., a buckle, is presented. Also included is an analysis of the forming pressure distribution in the gear tooth die cavity for estimation of forming loads and die stresses. Dissert. Abstr.

N77-24494*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRETTING OF AISI 9310 AND SELECTED FRETTING RESISTANT SURFACE TREATMENTS
R. C. Bill 1977 24 p refs Presented at Ann. Meeting of the Am. Soc. of Lubrication Engineers, Montreal, Canada, 3-5 May 1977
(NASA-TM-X-73591; E-9069) Avail: NTIS HC A02/MF A01 CSCL 11D
Fretting wear experiments were conducted with uncoated AISI 9310 mating surfaces, and with combinations incorporating a selected coating to one of the mating surfaces. Wear measurements and SEM observations indicated that surface fatigue, as made evident by spallation and surface crack formation, is an important mechanism in promoting fretting wear to uncoated 9310. Increasing humidity resulted in accelerated fretting, and a very noticeable difference in nature of the fretting debris. Of the coatings evaluated, aluminum bronze with a polyester additive was most effective at reducing wear and minimizing fretting damage to the mating uncoated surface, by means of a selflubricating film that developed on the fretting surfaces. Chromium plate performed as an effective protective coating, itself resisting fretting and not accelerating damage to the uncoated surface. Author

N77-24495*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APOLLO TELESCOPE MOUNT. A PARTIAL LISTING OF SCIENTIFIC PUBLICATIONS AND PRESENTATIONS, SUPPLEMENT 1
John M. Reynolds, ed. and William C. Snoddy, ed. May 1977 51 p
(NASA-TM-X-73393) Avail: NTIS HC A04/MF A01 CSCL 03A
Compilations of bibliographies from the principal investigator groups of the Apollo Telescope Mount (Skylab solar observatory facility) are presented. The publications listed are divided into the following categories: (1) journal publications, (2) journal publications submitted, (3) other publications, (4) presentations - national and international meetings; and (5) other presentations. Author

N77-24496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A CANTILEVER MOUNTED RESILIENT PAD GAS BEARING Patent Application
Izhak Etsion, inventor (to NASA) (NAS-NRC) Filed 28 Apr. 1977 12 p
(NASA-Case-LEW-12569-1; US-Patent-Appl-SN-792069) Avail: NTIS HC A02/MF A01 CSCL 13I
A gas-lubricated bearing employing at least one pad mounted on a rectangular cantilever beam to produce a lubricating wedge between the face of the pad and a moving surface is described. The load-carrying and stiffness characteristics of the pad are related to the dimensions and modulus of elasticity of the beam. The invention is applicable to a wide variety of types of hydrodynamic bearings. NASA

N77-24497*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPUTERIZED SYSTEM FOR TRANSLATING A TORCH HEAD Patent Application
William A. Wall, Jr., Robert E. Ives, M. Melvin Bruce, Jr., Peter Paul Pryor, Jr., and Leslie H. Gard, inventors (to NASA) Filed 20 May 1977 26 p
(NASA-Case-MFS-23620-1; US-Patent-Appl-SN-799023) Avail: NTIS HC A03/MF A01 CSCL 13H
A computerized system is described for translating a torch head tip at a constant travel speed along a contoured workpiece. It includes: a driven skate characterized by an elongated bed; a pair of independently pivotal trucks connected to the bed for support, which are mounted on a contoured track of an arbitrary configuration in mutually spaced relation; an axially extensible torch head manipulator arm mounted on the bed of the carriage, projected perpendicularly from the midportion with a torch head

mounted at its distal end; and a realtime computerized control drive subsystem to advance the skate along the track at a variable rate for maintaining a constant speed for the torch head tip, and to position the torch axis relative to a preset angle to the workpiece. NASA

N77-24498*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS PATH SEAL Patent Application
Robert C. Bill and Lawrence P. Ludwig, inventors (to NASA) Filed 27 May 1977 10 p
(NASA-Case-LEW-12131-1; US-Patent-Appl-SN-801290) Avail: NTIS HC A02/MF A01 CSCL 11A

A gas path seal suitable for use with a turbine engine or compressor is provided. A shroud wearable or abradable by the abrasion of the rotor blades of the turbine or compressor shrouds the rotor blades. A compliant backing surrounds the shroud. The backing may be made of corrugated sheets or the like with adjacent layers having off-set corrugations, with axes of the folds parallel to the rotor axis. The sheets may be bonded together at points of contact by brazing, welding, or the like. In another embodiment a compliant material is covered with a thin ductile layer. A mounting fixture surrounds the backing. NASA

N77-24499*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION AND WEAR PROPERTIES OF THREE HARD REFRACTORY COATINGS APPLIED BY RADIOFREQUENCY SPUTTERING
William A. Brainard Washington May 1977 21 p refs
(NASA-TN-D-8484; E-9055) Avail: NTIS HC A02/MF A01 CSCL 11D

The adherence, friction, and wear properties of thin hard refractory compound coatings applied to 440C bearing steel by radiofrequency sputtering were investigated. Friction and wear tests were done with nonconforming pin on disk specimens. The compounds examined were chromium carbide, molybdenum silicide, and titanium carbide. The adherence, friction, and wear were markedly improved by the application of a bias voltage to the bearing steel substrate during coating deposition. Analysis by X-ray photoelectron spectroscopy indicated that the improvement may be due to a reduction in impurities in bias deposited coatings. A fivefold reduction in oxygen concentration in MoSi2 coating by biasing was noted. Chromium carbide was not effective as an antiwear coating. Molybdenum silicide provided some reduction in both friction and wear. Titanium carbide exhibited excellent friction and antiwear properties at light loads. Plastic flow and transfer of the coating material onto the pin specimen appears to be important in achieving low friction and wear.
Author

N77-24500# Bendix Corp., Kansas City, Mo.
COST SAVING THROUGH APPLICATION OF THE INVESTMENT CASTING PROCESS
W. E. Cromwell, J. P. Paul, Jr., and G. L. Tiehen Aug. 1976 17 p refs Revised
(Contract E(29-1)-613)
(BDX-613-1126-Rev) Avail: NTIS HC A02/MF A01

Several XB 231 A mechanical assembly metal components were replaced with four investment castings, thereby realizing considerable cost saving. The XB231A mechanical assembly originally required mechanical components completely machined or assembled from wrought stock, but initial development showed that end product cost would be high because of the substantial amount of component machining and assembly time required. The degree of secondary machining necessary to arrive at the finished product was minimized, and requirements for function and reliability of the final assembly were satisfied. The parts were economically produced. ERA

N77-24501# Los Alamos Scientific Lab., N. Mex.
MULTIPLE HEPA FILTER TEST METHODS Progress Report, 31 Mar. - 31 Dec. 1975
Burton G. Schuster and Daniel J. Osetek Aug. 1976 21 p refs
(Contract W-7405-eng-36)
(LA-6443-PR) Avail: NTIS HC A02/MF A01

Measurements of efficiency as a function of particle size made on four HEPA filters display enhanced efficiency for collection of less than 0.10-micrometer and greater than 0.23-micrometer particles. Tests conducted on two samples of multi-ply HEPA filter yielded penetrations two and three orders of magnitude less than were indicated by 0.3-micrometer DOP quality control measurements. A complete trajectory analysis of the coaxial cylinder geometry was performed. The time necessary for a particle to be collected was compared to that obtained from a calculation using a quadrupole geometry. Preliminary measurements with the coaxial laboratory system have produced efficiency measurements ranging from 75 percent to 100 percent. A feasibility experiment determined that the hyperfine absorption lines at 633 nm of the I2 molecule would provide a detection mechanism for elemental iodine introduced into the resonant cavity of a He-Ne laser. ERA

N77-24502# Bendix Corp., Kansas City, Mo.
ELECTROCHEMICAL GRINDING
R. W. Stiles Aug. 1976 155 p refs
(Contract E(29-1)-613)
(BDX-613-1159) Avail: NTIS HC A08/MF A01

Cutting tests performed with an electrochemical surface grinder on 17-4 PH stainless steel, 303 Se stainless steel, 6061-T6 aluminum, and beryllium copper have established process standard deviations for dimensional variation, overcut, parallelism, flatness, and surface finish. Depths-of-cut studied were 0.001, 0.005, 0.010, 0.020, and 0.050 in. ERA

N77-24503# Sandia Labs., Livermore, Calif.
PROGRESS ON THE VARIABLE-DISPLACEMENT SPARK-IGNITION ENGINE
Oct. 1976 25 p refs Presented at ERDA Contractor's Coordination Meeting, Ann Arbor, Mich., 17 Oct. 1976
(Contract E(29-1)-789)
(SAND-76-8512; Conf-761028-1) Avail: NTIS HC A02/MF A01

A variable-displacement, five-cylinder, spark-ignition research engine was designed, fabricated, and is currently under test. During design, dynamic analyses of various configurations of the engine were done to determine member loads and unbalanced forces and to assist in selecting the linkage configuration. Dynamic analysis was also used to select five as the number of cylinders, to determine the firing order, to reduce engine vibration, and to compare vibration with that of a conventional engine. ERA

N77-24504# Stanford Research Inst., Menlo Park, Calif.
LONG TERM ENERGY ALTERNATIVES FOR AUTOMOTIVE PROPULSION. SYNTHETIC FUEL VERSUS BATTERY/ELECTRIC SYSTEM
E. E. Hughes, B. L. Walton, P. M. Newgard, J. W. Ryan, R. V. Steele, E. M. Dickson, S. M. Kohan, J. B. Kopelman, E. D. Oliver, and P. M. Halton Aug. 1976 17 p
(Contract NSF C-915; Grant NSF OEP-75-16162; SRI Proj. EGU-4064)
(PB-262512/7; SRI-EGU-4064; NSF/PRA-7516162; Rept-5) Avail: NTIS HC A01/MF A01 CSCL 13F

Conventional automobiles deriving fuel from coal by coal liquefaction processes are compared with electric cars using advanced batteries (such as the high temperature lithium-sulfur battery). Four comparison criteria--ease of transition from the present system, economics, energy requirements and environmental quality--were applied. GRA

N77-24505# Stanford Research Inst., Menlo Park, Calif.
LONG TERM ENERGY ALTERNATIVES FOR AUTOMOTIVE PROPULSION: SYNTHETIC FUEL VERSUS BATTERY/ELECTRIC SYSTEM Final Report
E. E. Hughes, B. L. Walton, P. M. Newgard, J. W. Ryan, R. V. Steele, E. M. Dickson, S. M. Kohan, J. B. Kopelman, E. D. Oliver, and P. M. Halton Aug. 1976 281 p refs
(Contract NSF C-915; Grant NSF OEP-75-16162; SRI Proj. EGU-4064)
(PB-262513/5; SRI-EGU-4064-FR; NSF/PRA-751616162-1-6) Avail: NTIS HC A13/MF A01 CSCL 13F
For abstract, see N77-24504.

N77-24506# Frankford Arsenal, Philadelphia, Pa.
EQUIPMENT FOR APPLYING PLASMA ARC-HOT WIRE

WELDED OVERLAYS ON PROJECTILE BODIES FOR ROTATING BANDS
Roger P. Stanton, Richard S. Schlauch, and Harry J. Addison, Jr. Aug. 1976 41 p refs
(AD-A034049; FA-TM-76047) Avail: NTIS HC A03/MF A01 CSCL 19/1

This report deals with the design and construction of a production type plasma arc-hot wire (PAHW) banding machine. The machine was constructed under contract and employs the PAHW process to apply ferrous or nonferrous overlays for rotating bands to large caliber projectiles. The machine is also equipped with a projectile chucking and rotating mechanism, loading and unloading station, oscillator mechanism, power supplies, appropriate timing (programming) and machine controls, and projectile and torch assembly cooling systems. GRA

N77-24507# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
PHYSICAL AND CHEMICAL PHENOMENA RESPONSIBLE FOR ODOR FORMATION IN DIESEL ENGINES Interim Progress Report, 15 Jun. - 15 Dec. 1976
N. P. Cernansky, C. W. Savery, I. H. Suffet, and R. S. Cochen 17 Dec. 1976 42 p refs
(Grant NSF AER-76-19752)
(PB-263173/7; NSF/RA-760409) Avail: NTIS HC A03/MF A01 CSCL 13B

A study of the physical and chemical phenomena responsible for odor formation in diesel engines was initiated. A single cylinder diesel engine test facility was modified and instrumented for studying odor formation and control. Also, an air aspirated spray burner facility was redesigned and refurbished for use. Odor sampling and analysis techniques and procedures were developed and preliminary engine odor samples were collected and analyzed. Supportive theoretical and modeling work was also initiated, and experimental tasks are reported. GRA

N77-24508# Battelle Columbus Labs., Ohio.
THE ROLE OF TEMPERATURE IN EHD
J. W. Kannel and F. F. Zugaro 27 Dec. 1976 45 p refs
(Contract N00014-76-C-0215)
(AD-A033930; BATT-G-6306) Avail: NTIS HC A03/MF A01 CSCL 11/8

A special transducer has been developed so that pressure and temperature measurements can be made (essentially) simultaneously. With this technique, it is possible to locate the contact zone temperatures relative to pressure to evaluate the relationship between heat generation and pressure. Temperature pressure data obtained using a synthetic mineral oil lubricant has been obtained for rolling and rolling-sliding contact in a special disk apparatus. Temperature rises on the order of 10-20C have been detected. Traction analyses indicate, in some instances that this level of temperature rise can explain the nonlinearity seen in traction-slip curves. GRA

N77-24509# Aeronautical Research Associates of Princeton, Inc., N. J.
THE SENSITIVITY OF IMPACT RESPONSE TO THE MECHANICAL BEHAVIOR OF THE PENETRATOR Interim Report, 1 Jul. 1974 - 31 Dec. 1975
Thomas B. McDonough and Ross M. Contiliano Jan. 1976 80 p refs
(Contract F44620-74-C-0045)
(AD-A033033; ARAP-266; AFOSR-76-1083TR) Avail: NTIS HC A05/MF A01 CSCL 20/11

A simple theory of impact which makes it easy to focus attention on the various physical phenomena which occur, and is simple enough so that the performance of parametric studies is economical is under development. The theory has progressed in steps, starting from the simplest model possible and gradually adding more complexities. This report presents the results of one step in the development: a study of the sensitivity of impact characteristics to the properties of the impacting particle. Four ideal models of behavior are treated: hydrodynamic, Newtonian fluid, rigid-plastic solid, and rigid. The effects on the impact process are presented in terms of the partitioning of the energy between particle and target, the deformation of the impacting particle, depth into the target the particle penetrates, and the target mass lost as a result of the cavity formation. The predicted trends with increasing impact velocity show some interesting and unforeseen results; for example, penetration depth does not increase always with increase of particle strength. GRA

N77-24510# AiResearch Mfg. Co., Phoenix, Ariz.
GAS TURBINE COMPRESSOR DEVELOPMENT PROGRAM FOR 1.513 KW GENERATOR SET Final Report, 28 Feb. 1974 - 31 Oct. 1975
Jessie B. Lee and Eugene A. Zanelli Dec. 1975 154 p refs
(Contract DAAK02-74-C-0167; DA Proj. 1G7-763702-DG-11)
(AD-A033577; AiResearch-75-311130) Avail: NTIS HC A08/MF A01 CSCL 21/5

This report summarizes a study that performed the preliminary design of a small gas turbine engine, capable of providing 6-hp for driving a 1.5/3 Kw generator set, and presents the results of performance testing the resultant compressor design. Author (GRA)

N77-24511# National Bureau of Standards, Washington, D. C. Engineering Mechanics Section.
SKID RESISTANCE MEASUREMENT TEST PROCEDURES FOR INTERCOMPARING FHWA NATIONAL AND REGIONAL REFERENCE SYSTEMS Final Report
Robert W. Kearns and John F. Ward Dec. 1976 34 p refs Sponsored in part by Federal Highway Administration
(PB-262366/8; NBSIR-76-1174) Avail: NTIS HC A03/MF A01 CSCL 13B

The measurement of the skid resistance of highways, under wet weather conditions, is part of the Federal Highway Administration (FHWA) skid-accident reduction program. A national reference system and regional reference systems are operated to improve the method of measurement, to reduce differences in results between systems and to include measurement assurance in the program. State highway measuring systems are intercompared with reference systems at FHWA regional field test centers. The objectives, scope and the general procedures of the tests used to intercompare the regional reference systems with the national reference system operated by the National Bureau of Standards are described. Listings of the general equipment required are included. GRA

N77-24512# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
TRAILER BRAKE PERFORMANCE Final Summary Report, Jun. 1975 - Sep. 1976
J. E. Bernard, C. B. Winkler, J. D. Campbell, and R. K. Gupta Nov. 1976 29 p
(Contract DOT-HS-5-01152)
(PB-262534/1; UM-HSRI-76-24-1; DOT-HS-802100) Avail: NTIS HC A03/MF A01 CSCL 13F

The mechanics of combination vehicle braking (where combination vehicles refers to passenger car trailer and pickup truck trailer combination vehicles) were evaluated. A rationale for measuring trailer braking properties was structured, and a set of guidelines by which tow and trailing vehicles can be properly matched to provide acceptable combination vehicle braking performance was formulated. Analytical and empirical work aimed toward attaining these goals, including parameter sensitivity studies employing digital computer simulation and full-scale track testing of five tow vehicles and five trailers is described. Parameter measurements of the test trailers were also included. GRA

N77-24513# Michigan Univ., Ann Arbor.
ROLLING RESISTANCE FORCES IN PNEUMATIC TIRES
S. K. Clark Jan. 1976 35 p refs
(Contract DOT-OS-50113)
(PB-262527/5; UMICH-013662-2-1; DOT-TST-76-74) Avail: NTIS HC A03/MF A01 CSCL 13F

An analysis is presented for the influence of test drum curvature on stress levels and resulting rolling resistance forces in pneumatic tires. The influence of test method on the measurement of rolling loss is also considered, and expressions are derived allowing rolling resistance measurements made on cylindrical drums to be transformed to flat surface values. Experimental verification is presented for the major conclusions. GRA

N77-24514# Faucett (Jack) Associates, Inc., Chevy Chase, Md.
TRUCK FLEET EXPERIENCE WITH FUEL ECONOMY IMPROVEMENT MEASURES
Jul. 1976 136 p refs
(Contract FEA-CO-04-50135)
(PB-263022/6; FEA/D-76/392) Avail: NTIS HC A07/MF A01 CSCL 13F

The major steps taken by the trucking industry to save fuel are reviewed. It includes a discussion of experience with individual conservation measures and contains a series of case studies detailing the various fuel economy improvements efforts of individual companies. GRA

N77-24515# Cornell Univ., Ithaca, N.Y. Coll. of Engineering.
COMPUTER-AIDED INJECTION MOLDING SYSTEM Progress Report, 1 Sep. 1975 - 31 Oct. 1976
K. K. Wang, S. F. Shen, J. F. Stevenson, and C. A. Hieber Oct. 1976 78 p refs
(Grant NSF APR-74-11490)
(PB-262903/8; NSF/RA-760360; PR-3) Avail: NTIS HC A05/MF A01 CSCL 13H

Injection molding is treated as a system of mold-design, mold manufacture, and process control, each of them involving the use of computer techniques dealing with such problems as part geometry, numerical simulation of fluid flow, process optimization, and generation of NC tape for machining. GRA

N77-24516# Avco Systems Div., Wilmington, Mass.
STATIC BRAKE INSPECTION INVESTIGATION, VOLUME 2 Final Technical Report, Jul. 1974 - Jul. 1976
Oct. 1976 347 p refs
(Contract DOT-HS-4-00949)
(PB-262792/5; DOT-HS-802071-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 13F

Methods are investigated and a system for motor vehicle brake inspection which precludes the necessity for wheel removal is devised. Requirements and criteria are reviewed, state-of-the-art equipment and methods are surveyed. Industry dialogue is established in support of feasibility of new concepts, which include vehicle modifications and new test methods. Inspection methods investigated include radiography, ultrasonics, acoustic emissions, acoustic signature, fiber optics, gas chromatography, etc. Alternatives are summarized, traded off and a final specification for brake inspection is recommended. The recommended specification includes proof test, visual wear indicators, access ports and simple inspection tools, GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-24517 British Library Lending Div., Boston Spa (England).
STANDARDIZING AND EVALUATING THE QUALITY OF METAL PRODUCTS
A. K. Petrov, V. V. Parabin, Yu. N. Kuznenko, and L. I. Markovich [1976] 9 p refs Transl. into ENGLISH from Stal (USSR), v. 9, 1976 p 856-858
(BLL-M-25522-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The scientific and technical basis of the quality indices and norms, regulated in the U.S.S.R. Gosstandart recommendations regarding the use of mathematical statistics for this purpose are evaluated. Nominal values of the indices are computed from limited data (selected); these are then compared with a nominal index on which the standard is based. The deviations by the existing index from its standard value can be gauged, from the effective quality of production by the index concerned, and the results of work at different works can be compared. Author

N77-24518# Atomics International, Golden, Colo.
NATURE OF MERCURY-ACTIVATED SILVER SOLIDSTATE BONDS
Virgil K. Grotzky, Clyde R. Rice, Joe H. Doyle, and Dave L. Olson 19 Nov. 1976 17 p ref
(Contract EY-76-C-04-3533)
(RFP-2514) Avail: NTIS HC A02/MF A01

A mercury-enhanced silver solid-state bond has produced reliable high strength joints in the bonding of Vascomax-250 (maraging steel). The joints are achieved by applying a uniform bond pressure across the mercury-activated silver-coated bonding surfaces at low temperatures. Mercury assists in making reproducible bonds by being an effective surface conditioner prior to bonding. The fractured surface morphology was analyzed by scanning electron microscopy and energy dispersive X-ray analysis. ERA

N77-24519# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
RELIABILITY ACCEPTANCE SAMPLING PLANS BASED UPON PRIOR DISTRIBUTION. VOLUME 2: RISK CRITERIA AND THEIR INTERPRETATION Final Technical Report, Jun. 1975 - Aug. 1976
Amrit L. Goel and Anand M. Joglekar Griffiss AFB, N. Y. RADC Sep. 1976 51 p refs 5 Vol.
(Contract F30602-71-C-0312)
(AD-A033516; TR-76-2; Vol-2; RADC-TR-76-294-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 12/2

This report deals with the definitions, interpretations and appropriateness of producer's and consumer's risks for the design of reliability acceptance sampling plans based upon prior distribution. The general approach presented here is applicable to any failure density and prior distribution. The specific case when the time to failure has an exponential distribution with parameter theta and theta has an inverted gamma prior distribution has been dealt with in detail. The definitions and the mathematical, physical and graphical interpretations of the various risks are discussed, and the risks are evaluated from the viewpoint of their meaningfulness to the producer and the consumer. The similarities and differences between acceptance sampling and demonstration, the implications behind the choice of minimum acceptable MTBF and specified MTBF, the basic interests of the producer and the consumer, and the choice of risks that reflect the primary interests of the producer and the consumer for various situations of practical interest are discussed. Author (GRA)

N77-24520# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
RELIABILITY ACCEPTANCE SAMPLING PLANS BASED UPON PRIOR DISTRIBUTION. VOLUME 4: DESIGN OF TESTING PLANS Final Technical Report, Jun. 1975 - Aug. 1976
Amrit L. Goel and Anand M. Joglekar Griffiss AFB, N. Y. RADC Sep. 1976 61 p refs 5 Vol.
(Contract F30602-71-C-0312)
(AD-A033576; TR-76-4-Vol-4; RADC-TR-76-294-Vol-4) Avail: NTIS HC A04/MF A01 CSCL 12/2

Numerical and graphical procedures for the design of reliability acceptance sampling plans are developed in this report. The failure distribution is considered to be exponential with parameter theta, and the prior distribution of theta is taken to be inverted gamma. These procedures are applicable when accept/reject decisions are to be made regarding a sequence of systems or lots. For specified combinations of producer-consumer risks, the numerical and the graphical procedures can be used for the design of a truncated single sample plan for a system. Other single sample plans can be obtained by using the equivalence relations derived in this report. The use and advantages of the graphical procedure are illustrated via numerical examples. GRA

N77-24521# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
RELIABILITY ACCEPTANCE SAMPLING PLANS BASED UPON PRIOR DISTRIBUTION. VOLUME 3: IMPLICATIONS AND DETERMINATION OF THE PRIOR DISTRIBUTION Final Technical Report, Jun. 1975 - Aug. 1976
Amrit L. Goel and Anand M. Joglekar Griffiss AFB, N. Y. RADC Sep. 1976 104 p refs 5 Vol.
(Contract F30602-71-C-0312)
(AD-A033517; TR-76-3-Vol-3; RADC-TR-76-296-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 12/2

This report deals with the determination of prior density for

the case when the parameter of the failure distribution is considered to be random. First, the implication of considering the parameter as a random variable on some aspects of reliability analysis is examined. The effect of the population heterogeneity model on acceptance sampling and the effect of individual heterogeneity model on failure distribution, acceptance sampling, burn-in and system reliability are considered. The determination of the functional form of the prior distribution and the reasons for choosing a conjugate prior are discussed. Methods are given for estimating the prior parameters based upon data from various sampling situations. A comprehensive analysis of some observed failure data, including a study of the efficiency of the estimators, is also presented. Author (GRA)

N77-24522# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.

RELIABILITY ACCEPTANCE SAMPLING PLANS BASED UPON PRIOR DISTRIBUTION. VOLUME 5: SENSITIVITY ANALYSES Final Technical Report, Jun. 1975 - Aug. 1976

Amrit L. Goel and Anand M. Joglekar Griffiss AFB, N. Y. RADC Sep. 1976 112 p refs 5 Vol.
(Contract F30602-71-C-0312)
(AD-A033518; TR-76-5-Vol-5; RADC-TR-76-294-Vol-5) Avail: NTIS HC A06/MF A01 CSCL 12/2

Sensitivity of designed plans and computed risks to changes in the prior parameters has been studied in this report. In the first part, the study is pursued for specified changes in the prior mean and the shape parameter. The second part involves an empirical quantification of the uncertainty in parameter estimates by using Monte Carlo simulation, likelihood contours and the asymptotic distribution of the parametric estimators. Author (GRA)

N77-24523# Army Construction Engineering Research Lab., Champaign, Ill.

THE EFFECTS OF CLUSTERED POROSITY ON THE SHEAR STRENGTH OF A 514F TRANSVERSE FILLET WELDS Final Report

H. S. Lamba and E. P. Cox Dec. 1976 27 p refs
(AD-A034662; CERL-TR-M-196) Avail: NTIS HC A03/MF A01 CSCL 13/5

This report presents the results of a study of the effects of clustered porosity on the transverse shear strength of A 514F steel weldments. The amount of porosity induced into the specimens ranged from zero to over 20 percent of the fracture surfaces. Results indicate that clustered porosity, up to about 10 percent, has little effect on the shear strength or ductility of transverse shear welds. A slight decline in shear strength was observed for larger amounts of porosity. Results also indicated that secondary defects in the fillet welds which were undetected by X-ray radiography reduced strength below that found in the specimens containing porosity only. Author (GRA)

N77-24524# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.

ACCELERATED LIFE TESTING AND RELATED TOPICS Final Report, 2 Jan. 1974 - 3 May 1976

Nozer D. Singpurwalla Sep. 1976 26 p
(Contract F33615-74-C-4040; AF Proj. 7071)
(AD-A034207; TM-66387; AFFDL-TR-76-71) Avail: NTIS HC A03/MF A01 CSCL 14/4

The report describes results of some research in accelerated life testing and related topics. The report is divided into seven sections, each section dealing with a particular category of the research. Each section contains bibliographic citations of papers relevant to the theme of that section. The sections are: physical models in accelerated life testing, inference from tests using physical models, models for competing risks, methods for step-stress testing and debugging, analysis for failure data from a changing environment, and computer programs for accelerated life test experiments. GRA

N77-24525# Defense Systems Management School, Fort Belvoir, Va.

A VIEW OF THE EVOLUTION OF THE RELIABILITY IMPROVEMENT WARRANTY (RIW)

Allan Edward Schmidt May 1976 47 p refs
(AD-A033952) Avail: NTIS HC A03/MF A01 CSCL 14/4

This report tracks DOD involvement in and development of a category of warranty which seeks good product reliability and also reliability growth or growth potential (called RIW) that has evolved over a number of years from DOD and industry experiences. The report provides a historical trail leading to RIW as used in DOD with primary emphasis on the Air Force's recent experience. Some commercial airlines' warranty concepts are discussed; then government and industry views are presented. The report details CODSIA involvement and role in RIW structuring and usage during the current DOD trial test of the concept-started in 1973. In 1974 it was further definitized and the term RIW and its concepts were presented for the trial use project. However, no specific trial/test parameters have been established. Currently the individual services may apply RIW as they determine, within overall DOD guidelines. Achievement or consummation of the assessment of RIW's merit, benefits, hazards and policies is the task that DOD is at grips with now. The author suggests alternatives to the current DOD RIW test approach, and recommends that: (1) the test be formalized for a period of 1 more year or less; (2) the current RIW programs be evaluated in depth and new programs be added very selectively (or not at all); and (3) DOD, CODSIA and ARINC coordinate or compromise on implementation details and contractual provisions based on the findings of the 1-year test (if RIW is approved as a concept for continued use). GRA

N77-24526# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.

PROPELLANT SURVEILLANCE REPORT LGM-30 F AND G STAGE 1, PHASE E, SERIES II, TP-H1011

John A. Thompson Oct. 1976 139 p refs
(AD-A034801; MANCP-360(76)) Avail: NTIS HC A07/MF A01 CSCL 21/8

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 F and G First Stage Minuteman Motors. This report uses a statistical approach to analyze the bulk carton propellant data. Testing was accomplished in accordance with MMEMP Project M72632-5MP116P. The data from this test period are combined with data from previous testing and entered into the G085 computer for storage, analysis and regression analysis. From the statistical analysis of all data tested to date (11 and one half years for F and G), significant degradation of the propellant does not appear likely for at least two years past the oldest data point. Each point on the regression plot represents the mean of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot or group of regression plots. The data range at any age can be found by suitable inquiry of the G085 system. Author (GRA)

N77-24527# Battelle Pacific Northwest Labs., Richland, Wash.

EVALUATION OF COMPUTER SIMULATED SIGNALS OR METALLIC TABS FOR STANDARDIZING EDDY CURRENT INSPECTION SYSTEMS Final Report

J. C. Crowe Dec. 1976 41 p refs
(Contract N00024-75-C-4436)
(AD-A034394) Avail: NTIS HC A03/MF A01 CSCL 20/3

Nondestructive evaluation of tubing using the eddy current method normally requires standardization or calibration of the testing system against a set of known conditions or references (standards). This report presents the results of a study undertaken at Battelle-Northwest to investigate alternate means of calibration which might reduce the uncertainties experienced with the fabricated flaw method and improve the accuracy and reproducibility of eddy current inspection. Two approaches were selected for study: (1) The production of calibrating signals from specially prepared metallic-calibration tabs or passive coils translated past the eddy current inspection coil assembly. (2) The injection of electronically developed signals into the electromagnetic field surrounding the eddy current inspection probe which represent calibration or flaw responses. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-24528 California Univ., Berkeley.
THE MECHANISMS OF DUCTILE FRACTURE Ph.D. Thesis
Mark Walter Perra 1976 150 p
Avail: Univ. Microfilms Order No. 77-4567

The growth of an isolated cylindrical void in plane strain was investigated using graphite filaments which served as nonadhering void nuclei, embedded in copper plane-strain specimens in such a way that their cylindrical axes lay normal to the plane of deformation. Two work-hardening rates were obtained by preparing specimens in both the annealed and highly cold-worked conditions. Three specimen shapes corresponding to side notches of included angle 0 deg, 90 deg, and 180 deg (plane-strain tension) were tested. The specimens were deformed by axial load, sectioned in the plane of deformation, and examined metallographically. After the local work-hardening rate had fallen below a critical value in the necks of the unnotched plane-strain tensile specimens, slipping off occurred along planes of maximum shear stress. Quadrangular channels were observed in the necks of these specimens, indicating void growth by localized shear.
Dissert. Abstr.

N77-24529 Kansas State Univ., Manhattan.
STRESSES AROUND LOADED METAL INSERTS IN PLASTICS Ph.D. Thesis
Hassan Higazi Ziada 1976 304 p
Avail: Univ. Microfilms Order No. 77-5549

Photoelastic techniques were used to determine experimentally the stress patterns in circular, square, and triangular metal inserts in plastic sheets. A finite element procedure was used to determine the stress in the plastic sheet. A finite element procedure was used to determine the stress in the plastic sheet with a circular rigid insert. A super position solution was used to describe the stress distribution within the elastic medium. The experimental and analytical results were compared along radial lines, and along the boundary at the interface and at 0.05 in. from the interface. Along radial lines, the radial stresses show good agreement for both analysis techniques. However, the experimental values for the tangential and shear stresses were higher than the mathematical values near the interface but not at the 0.05 in. distance. The experimental and analytical results have reasonable agreement in magnitude, trend, and location of maximum values.
Dissert. Abstr.

N77-24530 British Library Lending Div., Boston Spa (England).
RESEARCH INTO THE STRESSES DURING THE AXISYMMETRICAL HEATING OF A CONTINUOUS CYLINDER
V. M. Ryabkov, A. M. Tsun, and I. M. Tsun [1977] 6 p refs Transl. into ENGLISH from Izu. VUZ (USSR), v. 12, 1975 p 122-124
(BLL-M-25369-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Changes in the stressed state in a cylinder when it is heated are considered. Calculation results are used for plotting curves governing the moment at which the extreme values of stresses are reached at different points in the section of a cylinder with different values of the Biot criterion.
Author

N77-24531*# Wyle Labs., Inc., Hampton, Va. Scientific Services and Systems Group.
RESONANCE TESTING OF SPACE SHUTTLE THERMOACOUSTIC STRUCTURAL SPECIMEN Final Report
A. L. Abrahamson and John Osinski Mar. 1977 85 p refs
(Contract NAS1-12841)
(NASA-CR-145154; Rept-50621) Avail: NTIS HC A05/MF A01 CSCL 13M

The resonance testing of a structural specimen related to the space shuttle vehicle is described. The specimen consisted of a thin aluminum skin reinforced by hat-section stringers and supported by two ribs or bulkheads of corrugated web. A representative section of the space shuttle thermal protection system was bonded to the outer surface of the skin. The tests were completed by using miniature accelerometers to collect vibration data from locations forming a predetermined mesh over the tiles and base structure. The signals were recorded on FM magnetic tape and subsequently analyzed on a modal analysis system.
Author

N77-24532# Indian Inst. of Tech., Bombay. Dept. of Civil Engineering.
STRESS ANALYSIS OF ANISOTROPIC PLATES AND SHELLS: STATE-OF-THE-ART
Tarun Kant and Suresh Junghare Nov. 1976 77 p refs
(IIT-B/CE-76-1) Avail: NTIS HC A05/MF A01

Available papers are critically examined and the critical review is presented. Though it is found to be difficult to classify the literature available, an attempt has been made to classify them on the basis of the method of solution used, viz: (1) classical solutions, (2) numerical solutions of the differential equations finite difference and numerical integration; and (3) finite element idealizations.
Author

N77-24533# Oak Ridge National Lab., Tenn.
HEAT-TO-HEAT VARIATIONS OF TOTAL STRAIN (TO 5 PERCENT) AT DISCRETE STRESS LEVELS IN TYPES 316 AND 304 STAINLESS STEELS FROM 24 TO 316 DEG C
J. P. Hammond and V. K. Sikka 20 Oct. 1976 30 p refs
(Contract W-7405-eng-26)
(ORNL/NUREG/TM-57) Avail: NTIS HC A03/MF A01

Tensile tests were conducted on eight heats of randomly selected, mill-annealed type 316 stainless steel and seven heats of mill-annealed type 304 stainless steel at 24, 93, 204, and 316 C to establish the effects of heat-to-heat variations on total strain (to 5 percent) at discrete stress levels. Factors of difference were established between maximum and average strain (corresponding to minimum and nominal yield strength material respectively) for regulatory analysis applications. Limited tests were conducted to show the effects of product form and material condition on total strain.
Author (ERA)

N77-24534# Foster Wheeler Corp., Livingston, N.J.
INELASTIC BEHAVIOR OF FINITE CIRCULAR CYLINDRICAL SHELLS
J. M. Chern and D. H. Pai 1976 30 p refs Presented at the Intern. Joint Pressure Vessels and Piping and Petroleum Mechanical Engineering Conf., Mexico City, 19 Sep. 1976
(Contract E(48-1)-2170)
(HEDL-FW-6037; Conf-760905-15) Avail: NTIS HC A03/MF A01

A rate formulation is presented for the elastic-plastic-creep analysis of finite circular cylindrical shells with various end conditions subjected to varying axisymmetric pressure loads, through-the-wall and along-the-length temperature gradients, and either axial loads or axial deformations. The solution procedure is based on direct integration and successive approximation and shown to be efficient in dealing with complicated loading histories. Applications of the present method of analysis are illustrated by numerical examples histories. Applications of the present method of analysis are illustrated by numerical examples of elevated temperature design problem.
ERA

N77-24535# Battelle Columbus Labs., Ohio.
ELASTIC STRESSES AT REINFORCED NOZZLES IN SPHERICAL SHELLS WITH PRESSURE AND MOMENT LOADING
E. C. Rodabaugh and R. D. Gwaltney 20 Sep. 1976 49 p refs
(Contracts W-7405-eng-26; NRC-INA-40-495-75)
(ORNL/Sub-2913-4; PR-117-9R) Avail: NTIS HC A03/MF A01

The models used in the calculations represent a wide variety of reinforced shapes; all meeting code requirements. The results show code stress indices for pressure loading for nozzles with local reinforcement are acceptable with some modification in coverage. Simple equations for stress indices for moment loading are developed. Potential application of the moment-loading stress

indices is discussed. Several recommendations for code changes are included. ERA

N77-24536# Arbeitsgruppe fuer Ballistische Forschung, Weil am Rhein (West Germany).
CALCULATION OF THE ELASTIC TUBE BENDING VIBRATIONS USING THE CARBINE K 98 AS AN EXAMPLE [BERECHNUNG DER ELASTISCHEN ROHRBIEGESCHWINGUNGEN AM BEISPIEL DES KARABINERS K 98]
K. Wolf and R. Heiser Dec. 1975 110 p refs In GERMAN (ABF-4/75) Avail: NTIS HC A06/MF A01

The vertical elastic bending vibrations were calculated for the K 98 carbine barrel (caliber 7.62 mm) during projectile transit. The band was assumed to be fixed at one end. The calculation was based on vibration excitation by the projectile mass during transit through the barrel bent on account of its own weight. The bending vibrations and especially the muzzle's behavior as a function of tube mass, projectile mass, and projectile velocity were determined. The theoretical background is taken from Pestel's work. A comparison between theoretical and experimental results is not included. ESA

N77-24537# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
EFFECTS OF AN ADHESIVE PLASTER ON NOTCH STRESS INTENSITY AND DYNAMIC STRENGTH OF A CRACKED PLATE
Johannes Wiedemann and Curt Kranz 1976 44 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft
(ILR-15; ISBN-3-7983-0567-6) Avail: NTIS HC A03/MF A01

A comparative stress analysis using finite elements was carried out to evaluate the notch stress reduction effect of a plaster upon a cracked plate under tensile loading. The effect of the plaster is interpreted as a reduction of the effective crack length and described in terms of geometry and stiffness parameters, especially the adhesion. Elongation measurements on samples confirm the tendency of the computation results. The dynamic tests of cracked samples with plasters stuck on subsequently show a crack arresting effect with considerable increase in life. ESA

N77-24538# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
OPTIMIZATION OF THE LAYOUT OF LIGHT TRUSS STRUCTURES BY USING AN EVOLUTION STRATEGY [FORMOPTIMIERUNG VON LEICHTBAUFACHWERKEN DURCH EINSATZ EINER EVOLUTIONSSTRATEGIE]
Alfred Hoefler 1976 184 p refs In GERMAN
(ILR-17; ISBN-3-7983-0569-2) Avail: NTIS HC A09/MF A01

A method was developed for optimal setting of the variable form (node positions) of single or multipurpose trusses with statically predetermined topology (number of nodes, connections) with a view to minimizing weight. This nonlinear optimization problem was solved by using the evolution strategy, taking into consideration rod instability, proper weight, node number, and geometrical design space constraints. The semideterministic strategy, based on the biological principles of mutation and selection, adheres to the trajectory of the goal function gradients. The optimization method is combined with a design method for single-purpose trusses (Michell structure). ESA

N77-24539# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
APPLICATION OF SHADOW-OPTICAL CAUSTICS METHOD TO DETERMINATION OF FRACTURE MECHANICAL PARAMETERS FOR SUPERIMPOSED NORMAL AND SHEAR LOADING
U. Seidelmann Sep. 1976 62 p refs In GERMAN; ENGLISH summary
(Contract DFG-So-104/2)
(IFKM-WB-2/76) Avail: NTIS HC A04/MF A01

A shadow-optical method of caustics is used to determine the stress-intensity factors KI and KII for superimposed normal and shear loading. The applicability of the method in the subcritical range is verified, and critical values are measured for the onset of unsteady crack growth. The results are contrasted with the calculated predictions of three fracture hypotheses based on linear elasticity theory. It appears that these criteria do not provide a conservative estimate of the conditions for catastrophic growth of a crack subjected to mixed mode loading in the particular material investigated, namely Pmma. Author (ESA)

N77-24540# California Univ., Richmond. Earthquake Engineering Research Center.
TENSILE CAPACITY OF PARTIAL PENETRATION WELDS
Egor P. Popov and Roy M. Stephen Oct. 1976 40 p refs Sponsored in part by American Iron and Steel Inst.
(Grant NSF ENV-76-04263)
(PB-262899/8; EERC-76-28) Avail: NTIS HC A03/MF A01 CSCL 13E

The flanges of six W 14 x 320 sections with milled ends were joined together at mid height with different size partial penetration welds to form short columns; one additional specimen had full penetration welds through both flanges. Four of the specimens were failed directly in tension; three were subjected to a few compression tension cycles until failure. The experiments were designed to simulate conditions which can develop in some columns of steel frames during severe earthquakes. The spliced joints developed their specified strengths with the smallest weld attaining highest stress. Failure for all specimens with partial penetration welds occurred through the splice exhibiting very limited ductility. GRA

N77-24541# Transportation Systems Center, Cambridge, Mass.
FEASIBILITY OF FLAW DETECTION IN RAILROAD WHEELS USING ACOUSTIC SIGNATURES Final Report, Aug. 1972 - Aug. 1974
K. Nagy and R. D. Finch Oct. 1976 206 p refs Prepared by Houston Univ., Tex.
(Contract DOT-FRA-76-6)
(PB-263248/7; DOT-TSC-FRA-76-6; FRA/ORD-76-290) Avail: NTIS HC A10/MF A01 CSCL 13F

Determinations of the natural modes of vibrating wheels under various conditions are reported. Differences in acoustic signatures are found between good and cracked wheels, including spectral changes and variations in the time decay of sound. Various sounds occurring in normal railroad practice, such as rolling noise on welded rail and over joints and retarder screech, were investigated. It was concluded that special purpose impactors will have to be used for a serviceable device. Pattern recognition techniques were used for selecting good and bad wheels with a computerized processing scheme. A laboratory demonstration system has been constructed and found to be 85% reliable when system malfunctions are discounted. GRA

N77-24542# California Univ., Berkeley. Earthquake Engineering Research Center.
CORRELATIVE INVESTIGATIONS ON THEORETICAL AND EXPERIMENTAL DYNAMIC BEHAVIOR OF A MODEL BRIDGE STRUCTURE
Kazuhiko Kawashima and Joseph Penzien Jul. 1976 246 p refs
(Contract DOT-PH-11-7798)
(PB-263388/1; EERC-76-26) Avail: NTIS HC A11/MF A01 CSCL 13B

Descriptions are given of the correlations between analytical and experimental seismic responses of a model bridge structure which was constructed to have the same features as the typical full-scale high curved highway bridge structure. Modifications of the previously reported mathematical procedures for simulating the nonlinear behavior of expansion points are presented. These include subdividing the time interval of integration and applying an equilibrium correlation at the end of each interval and each subinterval. Correlations of displacement response of the bridge model carried out for the three different excitations are described. GRA

N77-24543# State Univ. of New York, Buffalo. Dept. of Engineering Science, Aerospace Engineering, and Nuclear Engineering.
A NOTE ON THE CRITICAL REFLECTIONS OF AXIALLY SYMMETRIC WAVES IN AN ISOTROPIC, ELASTIC, HOLLOW CYLINDER Summary Report
R. K. Kaul and G. Herrmann (Stanford Univ., Calif.) May 1976

21 p refs
(Contract N00014-75-C-0302)
(AD-A034887; Rept-100) Avail: NTIS HC A02/MF A01 CSCL 20/11

At critical incidence of equivoluminal waves, the wave motion evanesce in the case of an isotropic, elastic, hollow cylinder with traction-free cylindrical surfaces. However, it is shown that in this critical situation the wave motion can be obtained by using a suitable limiting procedure. Author (GRA)

N77-24544# Massachusetts Univ., Amherst.
VIBRATIONS OF THIN ELASTIC SHELLS: A NEW APPROACH
M. J. A. OCallaghan, W. A. Nash, and P. M. Quinlan Jul. 1976 8 p Presented at the IASS World Congress Space Enclosures, Montreal, Quebec, Jul. 1976
(Grant AF-AFOSR-2340-72)
(AD-A033942; AFOSR-76-1455TR) Avail: NTIS HC A02/MF A01 CSCL 20/11

A previous investigation by one of the present authors extended the method of Edge-Functions to the determination of natural frequencies and associated mode shapes of free vibration of thin elastic plates with a variety of boundary conditions. The present investigation further extends this approach to the case of a shallow elastic spherical shell of n-sided polygonal plan-form. Natural frequencies and associated mode shapes together with boundary residuals (indicating how well the approximate solution has satisfied boundary conditions) are readily displayed by the computer program offered. Results obtained in the present work are shown to be in excellent agreement with existing values for the specific boundary conditions treated. The present approach involves only modest computer efforts but offers the significant feature of rapid determination of how precisely the boundary conditions have been satisfied along each edge of the shell.
Author (GRA)

N77-24545# City Univ. of New York Research Foundation, N.Y.
ELASTIC PLATES AND SHELLS AND THE STABILITY OF THIN-WALLED STRUCTURES Final Report
Harry E. Rauch 30 Nov. 1976 6 p refs
(Grant AF-AFOSR-2063-71; AF Proj. 2304)
(AD-A033837; AFOSR-76-2063TR) Avail: NTIS HC A02/MF A01 CSCL 20/11

Progress on bending and buckling of plates and deep buckling and post-buckling regime analysis for complete spherical and oblate spheroidal shells is reported. The use of von Karman-type equations and the Galerkin method (with orthogonal series) is reported. Some new work on orthogonal expansions and hydrodynamic stability are also reported. Special emphasis is placed on new program for solving non-linear numerical equations in several variables. Author (GRA)

N77-24546# Army Materials and Mechanics Research Center, Watertown, Mass.
CONTACT PROBLEM FOR AN ORTHOTROPIC PLATE WITH A CIRCULAR HOLE LOADED BY A BOLT Final Report
Kanu R. Gandhi May 1976 18 p refs
(AD-A033367; AMMRC-TR-76-14) Avail: NTIS HC A02/MF A01 CSCL 20/11

The contact problem associated with a bolt bearing on a circular frictionless hole in a rectangular orthotropic plate has been examined. The problem has been formulated by the well-known methods of Muskhelishvili and Lekhnitskii using functions of complex variables. The orthotropic stress functions are expanded in Laurent series and boundary conditions satisfied by boundary collocation. A simple iterative process has been utilized with success to find the contact angle. The process utilizes the physical fact that the radial stress in the contact region is compressive and reduces to zero in a well-behaved manner at the point where the bolt begins to separate from the plate. The problem was motivated by the growing need in composite designs to gain analytical understanding of the joint. Some interesting results concerning the stress concentrations occurring in plates with various geometries and material parameters are presented. The results show the importance of complex interactions and the necessity of employing the particular method to estimate stress concentrations in problems of this nature. Author (GRA)

N77-24547# Tel-Aviv Univ. (Israel). School of Engineering.
CONTINUUM THEORIES FOR CYLINDRICAL WAVE PROPAGATION IN A LAMINATED MEDIUM Interim Report
Yako Benveniste Jul. 1976 26 p refs
(Grant AF-AFOSR-3014-76; AF Proj. 9782)
(AD-A033890; TAU-SOE/229-76; AFOSR-76-1246TR; SR-1)
Avail: NTIS HC A03/MF A01 CSCL 20/14

In this report, interacting continuum theories are developed for cylindrical wave propagation in a bi-laminated, linearly elastic, composite medium, in this case a cylindrical circular infinite cavity perpendicular to the layering of the composite. The laminated medium is subjected at the cavity wall to a nonaxisymmetric shear and normal loading uniform in the direction of the cavity axis. Two microstructure theories are developed: the first simulates the effectively two-dimensional plane motion of the medium which is due to a normal and shear loading in the circumferential direction; the second models the effectively anti-plane motion due to a shear loading in the direction of the cavity's axis. GRA

N77-24548# Florida State Univ., Tallahassee. Dept. of Statistics.
A SIMPLE MODEL WITH APPLICATIONS IN STRUCTURAL RELIABILITY, EXTINCTION OF SPECIES, INVENTORY DEPLETION, AND URN SAMPLING. 1. CUT SET FAILURE Interim Report
E. El-Neweihi (Kentucky Univ., Lexington), Frank Proschan, and Jayaram Sethuraman Nov. 1976 25 p refs
(Grants AF-AFOSR-2581-74)
(AD-A034403; FSU-Statistics-M391; AFOSR-76-1317TR; TR-65) Avail: NTIS HC A02/MF A01 CSCL 12/1

A series-parallel system consists of (k+1) subsystems C(0), C(1), ..., C(k), also called cut sets. Cut set C(i) contains n(i) components arranged in parallel, i = 0, 1, ..., k. No two cut sets have a component in common. It is assumed that after t components have failed, each of the remaining components in equally likely to fail, t = 0, 1, ... Consider the probability that the system fails because a specified cut set C(0), say fails first. Several alternative expressions and recurrence relations are obtained for this probability. Some of these formulae are useful in computations while others permit us to derive qualificative features like monotonicity, Schur-concavity, asymptotic limits, etc. These results are extended to the situation where some cut set size is first reduced to a, where a is a specified positive integer. The above model has applications in the study of reliability, extinction of species, inventory depletion, urn sampling, among others. GRA

N77-24549# Pennsylvania State Univ., University Park. Applied Research Lab.
MECHANICAL FOUR-POLE PARAMETERS: TRANSMISSION MATRICES
J. C. Snowdon 19 Apr. 1976 92 p refs
(Contract N00017-73-C-1418; SF43452702)
(AD-A034442; TM-76-122) Avail: NTIS HC A05/MF A01 CSCL 20/11

This report revises and extends an earlier report entitled 'Mechanical Four-Pole Parameters and their Application' (Journal of Sound and Vibration, 15, 307-323, 1971). Newly considered are so-called transmission matrices, which enable the transverse vibration response of beams with discontinuities to be analyzed readily. Further, the transmission matrices used in the report result in more concise beam analyses than the matrices generally employed in the literature. Additional examples that are considered here include end-driven cantilever beams or stanchions that are propped by a damped spring; or that carry an end mass having a finite moment of inertia; or that carry a mass that divides the stanchion into two stages of arbitrary lengths and cross-sectional areas; or that carry an end mass and subsequently comprise three stages having arbitrary lengths and cross-sectional areas.
GRA

N77-24550# California Univ., Berkeley. Earthquake Engineering Research Center.
CYCLIC SHEAR TESTS OF MASONRY PIERS. VOLUME 1: TEST RESULTS
Ronald L. Mayes, Yutaro Omote, and Ray W. Clough May

1976 108 p refs Sponsored in part by the Masonry Inst. of Am.
(Grant NSF AEN-73-07732)
(PB-264424/3; EERC-76-8-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 13M

The results of cyclic in plane shear tests on a variety of fixed ended masonry piers are presented. The test set-up is designed to simulate insofar as possible the boundary conditions the piers would experience in a perforated shear wall of a complete building. Each test specimen was a full scale panel about 15 feet (3 meters) square consisting of two piers and a top and bottom spandrel. The panels were constructed from 6 inch wide x 8 inch high x 16 inch long hollow concrete block units. The variables were the quantity and distribution of reinforcement including joint reinforcement, the rate of load application, partial grouting and the vertical bearing stress. GRA

42 GEOSCIENCES (GENERAL)

N77-24551*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE SCREWWORM ERADICATION DATA SYSTEM ARCHIVES
Charles M. Barnes, Robert R. Spaulding, and Lorrain E. Giddings (Lockheed Electronics Co., Inc.) Apr. 1977 30 p refs
(NASA-TM-X-58197; JSC-11432) Avail: NTIS HC A03/MF A01 CSCL 06C

The archives accumulated during 1 year of operation of the Satellite Temperature-Monitoring System during development of the Screwworm Eradication Data System are reported. Brief descriptions of all the kinds of tapes, as well as their potential uses, are presented. Reference is made to other documents that explain the generation of these data. Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N77-24552*# Science Applications, Inc., La Jolla, Calif.
COMMENT ON RELATIVE ATMOSPHERIC AEROSOL CONTENT FROM ERTS OBSERVATIONS
M. Griggs, Principal Investigator [1976] 3 p refs ERTS
(Contract NAS5-20899)
(E77-10157; NASA-CR-152711) Avail: NTIS HC A02/MF A01 CSCL 04A

There are no author-identified significant results in this report.

N77-24553*# Army Engineer District, San Francisco, Calif.
CALIFORNIA COASTAL PROCESSES STUDY, LANDSAT 2 Final Report, Feb. 1975 - Jan. 1977
Douglas M. Pirie (Earth Science Consulting and Technology, Costa Mesa, Calif.) and David D. Steller, Principal Investigators Apr. 1977 164 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-54062A)
(E77-10158; NASA-CR-153043) Avail: NTIS HC A08/MF A01 CSCL 08J

The author has identified the following significant results. By using suspended sediments as tracers, objectives were met by qualitative definition of the nearshore circulation along the entire coast of California with special study sites at Humboldt Bay, the mouth of the Russian River, San Francisco Bay, Monterey Bay, and the Santa Barbara Channel. Although LANDSAT primarily imaged fines and silts in the surface waters, the distribution of sediments allowed an examination of upwelling, convergences and coastal erosion and deposition. In Monterey Bay and Humboldt Bay, these coastal phenomena were used to trace seasonal trends in surface currents.

N77-24554*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Jan. - Mar. 1977
R. A. Halliday, Principal Investigator and I. A. Reid May 1977 9 p refs Sponsored by NASA ERTS
(E77-10159; NASA-CR-153044) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. During the winter of 1974-75, the number of transmissions dropped with lower temperatures and ceased at -20 C. During the winter of 1975-76, the same pattern occurred except that the platform ceased at slightly lower temperatures, probably due to the addition of 3, 1.5 V primary cells to the power supply. The next winter (1976-77), the same pattern occurred.

N77-24555*# Department of the Environment, Ottawa (Ontario).
HYDROLOGIC DATA RELAY BY SATELLITE FROM REMOTE AREAS
R. A. Halliday, Principal Investigator 1977 22 p refs Presented at Technical and Sci. Sessions on Water Resources World Water Conf., Mar del Plata, Argentina, 14-25 Mar. 1977 Sponsored by NASA ERTS
(E77-10160; NASA-CR-153045) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. Experimental use of LANDSAT data collection system and the GOES system has demonstrated the feasibility of using this technology to relay hydrologic data from remote areas on a near real time basis. The system has proved to be accurate, reliable, and cost effective.

N77-24556*# Department of the Environment, Ottawa (Ontario).
HYDROLOGIC APPLICATIONS OF THE TIROS-N ARGOS DATA COLLECTION SYSTEM
R. A. Halliday, Principal Investigator and I. A. Reid 1977 10 p refs Presented at 1st Argos Users Working Group Meeting, Washington, D. C., 21-22 Apr. 1977 Sponsored by NASA ERTS
(E77-10161; NASA-CR-153046) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N77-24557*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
WHEAT SIGNATURE MODELING AND ANALYSIS FOR IMPROVED TRAINING STATISTICS Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, W. A. Malila, R. C. Cicone, and J. M. Gleason May 1976 170 p refs EREP
(Contract NAS9-14123)
(E77-10162; NASA-CR-150997; ERIM-109600-66-F) Avail: NTIS HC A08/MF A01 CSCL 02C

The author has identified the following significant results. The spectral, spatial, and temporal characteristics of wheat and other signatures in LANDSAT multispectral scanner data were examined through empirical analysis and simulation. Irrigation patterns varied widely within Kansas; 88 percent of wheat acreage in Finney was irrigated and 24 percent in Morton, as opposed to less than 3 percent for western 2/3's of the State. The irrigation practice was definitely correlated with the observed spectral response; wheat variety differences produced observable spectral differences due to leaf coloration and different dates of maturation. Between-field differences were generally greater than within-field differences, and boundary pixels produced spectral features distinct from those within field centers. Multiclass boundary pixels contributed much of the observed bias in proportion estimates. The variability between signatures obtained by different draws of training data decreased as the sample size became larger; also, the resulting signatures became more robust and the particular decision threshold value became less important.

N77-24558*# Commission of the European Communities, Ispra (Italy).

AGRICULTURAL RESOURCES INVESTIGATIONS IN NORTHERN ITALY AND SOUTHERN FRANCE, AGRESTE PROJECT. PART 1: ACTIVITY PERFORMED ON THE ITALIAN TEST SITES Progress Report, 1 Jan. - 31 Mar. 1977

31 Mar. 1977 22 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E77-10163; NASA-CR-153042; PR-5) Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. It was found that the standard atmospheric correction procedure cannot be successfully applied to water targets if a better correlation of MSS data with radiance input to LANDSAT sensors was not reached. It was confirmed that the six line effect must be avoided unless more sophisticated data handling techniques allow subtraction of various amounts of path radiance for the six satellite detectors. The COPTRAN program for atmospheric corrections of scan angle influence on atmospheric path was modified and completed. Six rice varieties were discriminated in proportions ranging from 65 percent to more than 80 percent. The same techniques were applied to poplar groves with a 70 percent precision.

N77-24559*# Texas A&M Univ., College Station. Remote Sensing Center.

SPECTRAL MEASUREMENT OF WATERSHED COEFFICIENTS IN THE SOUTHERN GREAT PLAINS Progress Report, 1 Sep. 1976 - 28 Feb. 1977

Bruce J. Blanchard, Principal Investigator Mar. 1977 13 p ERTS

(Contract NAS5-22534)

(E77-10166; NASA-CR-152667; RSC-3273-5; RSC-3273-6) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N77-24560*# Battelle Columbus Labs., Ohio.

BENEFITS OF AN IMPROVED WHEAT CROP INFORMATION SYSTEM Final Report

Ivan L. Kinne Dec. 1976 39 p refs

(Contract NASw-2800)

(NASA-CR-153006; BCL-OA-TFR-76-12) Avail: NTIS HC A03/MF A01 CSCL 02C

The ECON work and the results of the independent reviews are summarized. Attempts are made to put this information into layman's terms and to present the benefits that can realistically be expected from a LANDSAT-type remote sensing system. Further the mechanisms by which these benefits can be expected to accrue are presented. The benefits are given including the nature of expected information improvements, how and why they can lead to benefits to society, and the estimated magnitude of the expected benefits. A brief description is presented of the ECON models, how they work, their results, and a summary of the pertinent aspects of each review. The ECON analyses show that substantial benefits will accrue from implementation of an improved wheat crop information system based on remote sensing. Author

N77-24561*# ECON, Inc., Princeton, N.J.

AN EVALUATION OF SEASAT-A CANDIDATE OCEAN INDUSTRY ECONOMIC VERIFICATION EXPERIMENTS Final Report

1 Apr. 1977 249 p refs

(Contract NASw-3047)

(NASA-CR-153009; Rept-76-242-1) Avail: NTIS HC A11/MF A01 CSCL 05C

A description of the candidate economic verification experiments which could be performed with SEASAT is provided. Experiments have been identified in each of the areas of ocean-based activity that are expected to show an economic impact from the use of operational SEASAT data. Experiments have been identified in the areas of Arctic operations, the ocean fishing industry, the offshore oil and natural gas industry, as well as ice monitoring and coastal zone applications. Author

N77-24562*# Old Dominion Univ. Research Foundation, Norfolk, Va.

THE USE OF SKYLAB IN THE STUDY OF PRODUCTIVITY ALONG THE EASTERN SHELF WATERS OF THE UNITED STATES Final Report

Harold G. Marshall and David E. Bowker Mar. 1976 28 p refs

(Contract NAS1-11707)

(NASA-CR-152848) Avail: NTIS HC A03/MF A01 CSCL 08A

Data sampling from the Rappahannock River and Assateague Island areas are discussed correlating Skylab and ground based measurements. At all sampling stations, information was obtained on composition and density of phytoplankton, total chlorophyll, salinity and water temperature. The results of the water analysis are presented in tables. M.C.F.

N77-24563*# Goodwin (Glen), Sun City, Ariz.

BENEFIT AND IMPACT OF THE ARIZONA LAND-USE EXPERIMENT: EXECUTIVE SUMMARY

Glen Goodwin 3 Jan. 1977 16 p

(NASA Order A-23739)

(NASA-CR-151985) Avail: NTIS HC A02/MF A01 CSCL 08B

The benefits and impact of the Arizona Land-Use Experiment on the people of Arizona are examined along with the process of the technology transfer to the political and private sector of the Arizona community. Since the remotely-sensed data in use in Arizona consisted of a blend of spacecraft and aircraft information, it was hoped that the role of the aircraft in the transfer process would be identified and its benefit be determined in a real-world situation. In addition, the role of the institutional arrangements set up in Arizona to facilitate the transfer of remotely-sensed information to the user community was examined. Author

N77-24564*# Goodwin (Glen), Sun City, Ariz.

BENEFIT AND IMPACT OF THE ARIZONA LAND-USE EXPERIMENT

Glen Goodwin 3 Jan. 1977 91 p

(NASA Order A-23739-B)

(NASA-CR-151986) Avail: NTIS HC A05/MF A01 CSCL 05B

For abstract, see N77-24563.

N77-24565*# Scientific Translation Service, Santa Barbara, Calif.

THE INVESTIGATION OF THE ENVIRONMENT BY SPACE MEANS: GEOBOTANICS, GEOMORPHOLOGY, SOIL SCIENCE AGRICULTURAL LAND, AND LANDSCAPE SCIENCE

S. V. Zoni, L. A. Vedeshin, and A. M. Grinberg Washington NASA May 1977 309 p refs Transl. into ENGLISH of collection of papers presented at the Methods of Utilizing Aerospace Data Meeting, Moscow, 17-24 Nov. 1975

(Contract NASw-2791)

(NASA-TT-F-17529) Avail: NTIS HC A14/MF A01 CSCL 05B

Collection of papers presented at the Methods of Utilizing Aerospace Data Meeting in Moscow. Topics covered include all aspects of the interpretation of aerial photographs from satellites for agriculture and related fields. Author

N77-24566*# City Coll. of the City Univ. of New York.

THE DETERMINATION OF SURFACE ALBEDO FROM METEOROLOGICAL SATELLITES

Winthrop T. Johnson 1 Jun. 1977 41 p refs

(Grant NGR-33-013-086)

(NASA-CR-153077) Avail: NTIS HC A03/MF A01 CSCL 03B

A surface albedo was determined from visible data collected by the NOAA-4 polar orbiting meteorological satellite. To filter out the major cause of atmospheric reflectivity, namely clouds, techniques were developed and applied to the data resulting in a map of global surface albedo. Neglecting spurious surface albedos for regions with persistent cloud cover, sun glint effects, insufficient reflected light and, at this time, some unresolved influences, the surface albedos retrieved from satellite data closely matched those of a global surface albedo map

produced from surface and aircraft measurements and from characteristic albedos for land type and land use. Author

N77-24567*# National Aeronautics and Space Administration, Washington, D. C.
SEASAT GLOBAL OCEAN MONITORING SYSTEM
[1977] 101 p
(NASA-TM-X-74621) Avail: NTIS HC A06/MF A01 CSCL 05B

General information and descriptive material about the SEASAT program is given. This is the central document covering the program. Author

N77-24568# Lockheed Missiles and Space Co., Palo Alto, Calif.
METHOD OF DETERMINING AND INVESTIGATING THE DEPENDENCE OF AIRCRAFT THERMAL DETECTORS RESOLUTION ON OBJECT CONTRAST
A. M. Shirobokov [1976] 4 p refs Transl. into ENGLISH from Optiko-Mekhanicheskaia Promyshl. (USSR), no. 4, 1976 p 75-77
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

An aircraft heat detector was studied by using a new method. The resolution was determined for comparatively high contrasts between the objects and the background, which corresponded to a 10 deg initial temperature drop. A photograph was taken on type 15 isopanchrome aerial photography film and developed in UP-2. The objects were gray rectangular objects with emissivity e = 0,95. The dependence of the resolution level of the heat detector under investigation, and of the resolution, on the contrast are shown. Knowledge of the dependence of the resolution on the object contrast permits a deeper analysis of the heat maps obtained by using the heat detector. Author

N77-24569*# ECON, Inc., Princeton, N.J.
UNITED STATES BENEFITS OF IMPROVED WORLDWIDE WHEAT CROP INFORMATION FROM A LANDSAT SYSTEM OVERVIEW Final Report
30 Jan. 1976 47 p refs Revised
(Contract NASw-2558)
(NASA-CR-153061; Rept-76-122-1A) Avail: NTIS HC A03/MF A01 CSCL 02C

The value of improvements in worldwide information on wheat crops provided by LANDSAT was measured in the context of world wheat markets. These benefits were based on exiting LANDSAT technical goals and assumed that information would be made available to the United States and other countries at the same time. The benefits to the United States of such public LANDSAT information on wheat crops were found to be 174 million dollars a year on the average. The benefits from improved wheat crop information compare favorably with the annual system's cost of about $62 million. A detailed empirical sample demonstration of the effect of improved information was developed. The history of wheat commodity prices for 1971-72 was reconstructed and the price changes from improved vs. historical information were compared. Author

N77-24570*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DATA-HANDLING CONSIDERATIONS FOR ADVANCED HIGH-RESOLUTION MULTISPECTRAL SCANNERS
Sidney L. Whitley Washington May 1977 24 p refs
(NASA-TN-D-8489; JSC-S-472) Avail: NTIS HC A02/MF A01 CSCL 05B

Several scanner design parameters that greatly affect data rates were varied to determine overall effect on data rates. Bit rates were calculated for scanners with 10-, 15-, 20-, and 30-meter instantaneous fields of view; with 5, 7, and 10 channels; and with swath widths of 46.3, 92.6, 138.9, and 185.2 kilometers (25, 50, 75, and 100 nautical miles). The data were analyzed to determine whether they could be (1) recorded onboard the spacecraft with currently available equipment, (2) recorded onboard with the equipment proposed for the 1980-90 period, (3) transmitted to earth with current or proposed equipment; and (4) compressed and decompressed without significant degradation of classification accuracy. The effect of classifying 10-meter scanner data on the existing and the development pattern-recognition systems was examined. Author

N77-24571# Southwest Research Inst., San Antonio, Tex. Div. of Geothermal Energy.
DEVELOPMENT OF AN ASSESSMENT METHODOLOGY FOR GEOPRESSURIZED ZONES OF THE UPPER GULF COAST BASED ON A STUDY OF ABNORMALLY PRESSURED GAS FIELDS IN SOUTH TEXAS Final Report
R. K. Swanson, P. Oetking, J. S. Osoba, and R. C. Hagens Aug. 1976 122 p refs
(Contract E(11-1)-2687)
(COO-2687-5) Avail: NTIS HC A06/MF A01

Individual fields were assessed for their potential to produce large quantities of geothermal fluid based on reservoir study and detailed geological investigation. Five locations within the study region have been selected as potential candidates for further evaluation and possible eventual testing. Based on investigation of permeability and temperature, the upper limit of fluid temperature likely to be produced in the lower south Texas study region is 300 F. In Live Oak County, the possibility of producing fluid at higher temperatures is somewhat improved, with a reasonable possibility of producing fluid at 350 to 375 F. ERA

N77-24572# Federal Energy Administration, Washington, D. C. Strategic Petroleum Reserve Office.
STRATEGIC PETROLEUM RESERVE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR CENTRAL ROCK MINE
Dec. 1976 463 p refs
(PB-262390/8; EEA/S-76/489; DES-76-9) Avail: NTIS HC A20/MF A01 CSCL 21D

The present action is part of the ESR (Energy Storage Reserve) and proposes to store 14 million barrels of oil in an underground limestone mine located in Lexington, Kentucky. The proposed storage of oil at Central Rock Mine would be implemented at an existing underground limestone mine presently owned and operated by the Central Rock Company. This site-specific Environmental Impact Statement (EIS) has identified particularly sensitive environmental parameters that were investigated. GRA

N77-24573# Federal Energy Administration, Washington, D. C. Strategic Petroleum Reserve Office.
STRATEGIC PETROLEUM RESERVE. DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR IRONTON MINE
Dec. 1976 487 p refs
(PB-262451/8; FEA/S-76/490) Avail: NTIS HC A21/MF A01 CSCL 21D

The Federal Energy Administration (FEA) proposes to implement the Strategic Petroleum Reserve to mitigate the social and economic impacts of any future interruptions of petroleum imports. The Reserve will store 150 million barrels of oil by December of 1978 in the Early Storage Reserve (ESR), and 500 million barrels by 1982 under the entire program. Particularly sensitive environmental parameters for the Ironton, Ohio Early Storage Reserve site are identified. GRA

N77-24574# RCA Advanced Technology Labs., Camden, N. J.
SCANNING CURSOR TECHNIQUES Final Technical Report, Jun. 1974 - May 1976
G. W. Hunka Dec. 1976 58 p
(Contract F30602-74-C-0318)
(AD-A034599; ATL-CR-76-05; RADC-TR-76-363) Avail: NTIS HC A04/MF A01 CSCL 08/2

This report describes the effort to design, fabricate and test a digitizing cursor with integral line centering capability. The resultant cursor is transmissive in nature utilizing a linear photodiode array, an optical system and array signal processing electronics. Processor output is a binary count representing position of the image traced feature on the array. A computer algorithm uses the information as a corrective term to yield accurate coordinate data. Computer-generated rotational commands serve to continuously position the array to be orthogonal to the feature to ensure maximum accuracy in tracing features containing curvatures or forming closed contours. Accuracy of + or - .003 inch is obtainable in digitizing with the cursor.
Author (GRA)

N77-24575# PRC Information Sciences Co., McLean, Va.
USER'S MANUAL FOR THE REFERENCE SCENE SOFTWARE (RSS)
Steven H. Moritz 15 Oct. 1976 77 p

(Contract DAAK02-75-C-0098)
(AD-A033631; PRC-R-1938; ETL-0066) Avail: NTIS HC A05/MF A01 CSCL 08/2

The Reference Scene Software (RSS) is a set of eleven CDC 6400 computer programs used in-house at the U.S. Army Engineer Topographic Laboratories (USAETL), Ft. Belvoir, Virginia, to produce simulated Plan Position Indicator (PPI) radar scenes. The two inputs required by RSS are a matrix array (raster format) of digital terrain elevations and a corresponding vector digitized list of planimetry features (roads, lakes, railroads, cities, rivers, etc.). The output of RSS is a raster format magnetic tape image of the circular PPI scene, which is later formatted onto 35mm film and machine compared to the actual scene of the area to determine the 'goodness' of correlation. These programs were originally developed by the Naval Training Equipment Center (NTEC), Orlando, Florida, for visual flight simulation. They were converted to run on the ETL CDC 6400 computer, new input and output routines were developed, and the radar modeling algorithm was changed to produce a better machine readable rather than better human readable scene. RSS is being used to determine the data base input requirements and the radar modeling algorithm parameters necessary for producing 'correlatable' reference scenes. GRA

N77-24576# Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
NUMERICAL MODELING OF DISPERSION IN STRATIFIED WATERS
George Christodoulou and Jerome J. Connor 20 Nov. 1976 25 p refs
(Grant NOAA-04-6-158-44007)
(PB-263379/0; MITSG-76-17; NOAA-76122912) Avail: NTIS HC A02/MF A01 CSCL 08C

The dispersion process in a two layer system which represents an approximation for a natural coastal water body during the summer season when a distinct thermocline usually exists is quantitatively described using a formulation based on the convection-diffusion equation, vertically integrated between the layer boundaries. Layer velocities and thicknesses are assumed to be obtained from a separate hydrodynamic model. The quantification of the physical processes of entrainment and mixing through the density interface as well as the horizontal dispersion mechanism is discussed. The model is applied to a particle dispersion experiment carried out recently in the Massachusetts Bay and comparisons with field data are presented. GRA

N77-24577# Stanford Univ., Calif. Dept. of Petroleum Engineering.
MATHEMATICAL MODELLING OF SINGLE-PHASE NONISOTHERMAL FLUID FLOW THROUGH POROUS MEDIA Ph.D. Thesis
Paul Gardiner Atkinson May 1976 209 p refs
(Grant NSF AER-72-03490-A03)
(PB-262884/0; NSF/RA-760404) Avail: NTIS HC A10/MF A01 CSCL 08I

A series of mathematical models are developed to describe heat transfer in laboratory experiments using cylindrical cores in a Hassler-type coreholder. The models are general and can also be used to study behavior encountered in other laboratory arrangements. Analytical solutions are derived and the behavior of these solutions is studied to determine the interaction of the heat transfer mechanisms in laboratory cores. The mathematical models are evaluated by comparison of calculated results with published experimental data. GRA

N77-24578# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
AN EXPERIMENTAL INVESTIGATION OF THE RAINFALL ON THE TURBULENCE PROPERTIES OF OVERLAND FLOW
Hagop Shahabian and Jacques W. Delleur Dec. 1976 128 p refs Sponsored by Office of Water Res. and Technol.
(PB-263494/7; TR-88; W77-04177; OWRT-A-037-IND(1)) Avail: NTIS HC A07/MF A01 CSCL 08M

The principal turbulence characteristics of two-dimensional shallow water flow on a smooth boundary with and without rainfall were studied. The mean and fluctuating components of the longitudinal and vertical velocities, and the corresponding Reynolds stress were measured through the depth of the flow and the mean and fluctuating components of the bottom shear stress were obtained by means of a split hot film sensor and a shear stress sensor respectively. The spectral density estimates and autocorrelation functions for each of the shear stresses and of the velocities are calculated and presented. GRA

N77-24579# Federal Energy Administration, Washington, D. C. Strategic Petroleum Reserve Office.
STRATEGIC PETROLEUM RESERVE. BRYAN MOUND SALT DOME Final Environmental Impact Statement
Jan. 1977 534 p refs
(PB-262839/4; FEA/S-76/502; FES-76/77-6) Avail: NTIS HC A23/MF A01 CSCL 21D

The implementation of Strategic Petroleum Reserve (SPR), of the Energy Policy and Conservation Act of 1975 initiated the development of a 58 million barrel crude oil storage facility at the Bryan Mound Salt Dome. The purpose of the SPR is to mitigate the economic impacts of any future interruptions of the petroleum imports. Under the initial phase of the SPR, referred to as the Early Storage Reserve (ESR), one hundred fifty million barrels of oil will be stored by 1978. The Bryan Mound site, a salt dome with existing cavities located in Brazoria County, Texas, has been identified as a candidate site of the ESR because it offers the advantage of large storage capacity, easy access to the distribution network, and a relatively short preparation period. This site-specific EIS analyzes the environmental impacts caused by site preparation and operation. GRA

N77-24580# Federal Energy Administration, Washington, D. C. Strategic Petroleum Reserve Office.
STRATEGIC PETROLEUM RESERVE. WEST HACKBERRY SALT DOME Final Environmental Impact Statement
Jan. 1977 616 p refs
(PB-262508/5; FEA/S-76/503; FES-76/77-4) Avail: NTIS HC A99/MF A01 CSCL 21D

Under the initial phase of the SPR (Strategic Petroleum Reserve), referred to as the Early Storage Reserve (ESR), one hundred fifty million barrels of oil will be stored by 1978. This site-specific EIS analyzes the environmental impacts caused by site preparation and operation. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-24581*# Solarex Corp., Rockville, Md.
SOLAR BREEDER: ENERGY PAYBACK TIME FOR SILICON PHOTOVOLTAIC SYSTEMS
Joseph Lindmayer Apr. 1977 57 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954606)
(NASA-CR-153060; QR-1; ERDA/JPL-954606-77/1; SX/111/1Q) Avail: NTIS HC A04/MF A01 CSCL 10A

The energy expenditures of the prevailing manufacturing technology of terrestrial photovoltaic cells and panels were evaluated, including silicon reduction, silicon refinement, crystal growth, cell processing and panel building. Energy expenditures include direct energy, indirect energy, and energy in the form of equipment and overhead expenses. Payback times were development using a conventional solar cell as a test vehicle which allows for the comparison of its energy generating capability with the energies expended during the production process. It was found that the energy payback time for a typical solar panel produced by the prevailing technology is 6.4 years. Furthermore, this value drops to 3.8 years under more favorable conditions. Moreover, since the major energy use reductions in

terrestrial manufacturing have occurred in cell processing, this payback time directly illustrates the areas where major future energy reductions can be made -- silicon refinement, crystal growth, and panel building. Author

N77-24582*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A 1.8 BY 3.7 METER FRESNEL LENS SOLAR CONCENTRATOR
Leon J. Hastings, Steve L. Allums, and Warren S. Jensen Apr. 1977 75 p refs
(NASA-TM-X-73392) Avail: NTIS HC A04/MF A01 CSCL 10A

Line-focusing acrylic Fresnel lenses with application potential in the 200 to 370 C range are analytically and experimentally evaluated. Investigations previously conducted with a 56 cm wide lens were extended to experimentation/analyses with a 1.8 by 3.7 m lens. A measured peak concentration ratio of 64 with 90 percent of the transmitted energy focused into a 5.0 cm width was achieved. A peak concentration of 61 and a 90 percent target width of 4.5 cm were analytically computed. The experimental and analytical lens transmittance was 81 percent and 86 percent, respectively. Thus, the analytical/experimental lens performance correlation is considered good. The lens also was interfaced with a receiver assembly and operated in the collection mode. The collection efficiency ranged from 42 percent at 100 C to 26 percent at 300 C, whereas an efficiency of 40 percent at 300 C was anticipated. Apparently, the reflective cavity surrounding the absorber tube did not perform as expected. Author

N77-24583*# Columbia Univ., New York. Dept. of Chemical Engineering and Applied Chemistry.
EFFECT OF PULSED CURRENT CHARGING ON THE PERFORMANCE OF NICKEL-CADIUM CELLS Final Report
A. A. Bedrossian and H. Y. Cheh Jan. 1977 225 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953970)
(NASA-CR-153200) Avail: NTIS HC A10/MF A01 CSCL 10C

The effect of pulsed current charging on the charge acceptance of NiCd cells in terms of mass transfer, kinetic, and structural considerations was investigated. A systemic investigation on the performance of Ni-Cd cells by pulsed current charging was conducted under a variety of well-defined charge-discharge conditions. Experiments were carried out with half cells and film electrodes. The system behavior was studied by charge acceptance, mechanistic, and structural measurements. Author

N77-24584*# Texas Instruments, Inc., Dallas.
SILICON MATERIAL TASK. PART 3: LOW-COST SILICON SOLAR ARRAY PROJECT Final Report
R. A. Roques and D. M. Coldwell Jan. 1977 74 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954412)
(NASA-CR-153064; ERDA/JPL-954412-77-Pt-3; TIRN-03-77-05-Pt-3) Avail: NTIS HC A03/MF A01 CSCL 10A

The feasibility of a process for carbon reduction of low impurity silica in a plasma heat source was investigated to produce low-cost solar-grade silicon. Theoretical aspects of the reaction chemistry were studied with the aid of a computer program using iterative free energy minimization. These calculations indicate a threshold temperature exists at 2400 K below which no silicon is formed. The computer simulation technique of molecular dynamics was used to study the quenching of product species. Author

N77-24585*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CRITICAL AREAS: SATELLITE POWER SYSTEMS CONCEPTS
Jul. 1975 168 p
(NASA-TM-X-74694; JSC-10873) Avail: NTIS HC A08/MF A01 CSCL 10A

Critical Areas are defined and discussed in the various areas pertinent to satellite power systems. The presentation is grouped into five areas (General, Space Systems, Solar Energy Conversion, Microwave Systems, and Environment/Ecology) with a sixth area (Power Relay) considered separately in an appendix. Areas for Future Consideration as critical areas are discussed in a second appendix. Author

N77-24586# Lockheed Missiles and Space Co., Palo Alto, Calif.
USE OF RADIATION REFLECTED FROM EARTH TO INCREASE THE POWER OF SOLAR PANELS
N. M. Bordina, N. A. Borisova, G. S. Daletskii, V. V. Zaode, A. K. Zaitseva, A. P. Landsman, and U. A. Letin [1976] 8 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 14, no. 2, 1976 p 293-298
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Computations of the direct and earth-reflected solar radiation fluxes reaching the panels of solar batteries (SP) mounted on an artificial earth satellite are presented. Different modes of SP orientation are considered. An estimate is made to intensify SP power using radiation reflected from earth on two-sided SP. Author

N77-24587*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BASELINE PERFORMANCE OF SOLAR COLLECTORS FOR NASA LANGLEY SOLAR BUILDING TEST FACILITY
Richard H. Knoll and Susan M. Johnson Washington May 1977 25 p refs
(NASA-TM-X-3505; E-9036) Avail: NTIS HC A02/MF A01 CSCL 10A

The solar collector field contains seven collector designs. Before operation in the field, the experimental performances (thermal efficiencies) of the seven collector designs were measured in an indoor solar simulator. The resulting data provided a baseline for later comparison with actual field test data. The simulator test results are presented for the collectors as received, and after several weeks of outdoor exposure with no coolant (dry operation). Six of the seven collector designs tested showed substantial reductions in thermal efficiency after dry operation. Author

N77-24588# Energy Research and Development Administration, Washington, D.C. Div. of Solar Energy.
AN ECONOMIC ANALYSIS OF SOLAR WATER AND SPACE HEATING
Nov. 1976 74 p refs
(DSE-2322-1) Avail: SOD HC $1.85

Solar system designs for 13 cities were optimized so as to minimize the life cycle cost over the assumed 20 year life time of the solar energy systems. The major assumptions regarding the solar system, type and use of building, financial considerations, and economic environment used in the design optimization were included. Author

N77-24589*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF SEMICONDUCTOR DIFFUSANTS TO SOLAR CELLS BY SCREEN PRINTING Patent Application
John C. Evans, Jr., Henry W. Brandhorst, George A. Mazaris, and Larry R. Scudder, inventors (to NASA) Filed 20 May 1977 18 p
(NASA-Case-LEW-12775-1; US-Patent-Appl-SN-799026) Avail: NTIS HC A02/MF A01 CSCL 10A

Diffusants are applied onto semiconductor solar cell substrates using screen printing techniques. The method is applicable to square and rectangular cells and is used to apply dopants of opposite types to the front and back of the substrate. Then, simultaneous diffusion of both dopants is performed with a single furnace pass. NASA

N77-24590*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SUN TRACKING SOLAR ENERGY COLLECTOR Patent Application
Gerald S. Perkins, inventor (to NASA) (JPL) Filed 6 Apr. 1977 12 p
(Contract NAS7-100)
(NASA-Case-NPO-13921-1; US-Patent-Appl-SN-785257) Avail: NTIS HC A02/MF A01 CSCL 10A

A parabolic reflector is supported so that it can track the sun. The support for this reflector comprises an azimuth frame supported on two wheels and a central pivotal point which are positioned in a substantially triangular configuration. The two wheels rotate on tracks. On top of the azimuth frame, there is provided an elevation frame. The elevation frame includes curved rails which define a portion of an arc and extend vertically. The reflector rides on wheels captured within the curved rails. The wheels of the azimuth frame are driven by an azimuth actuator. The reflector structure is counterbalanced about its elevation axis by a pendulum cable system which is driven by a motor to change elevation. At the focal point of the parabolic reflector, a heat engine or receiver is mounted independently of the reflector. Author

N77-24591# Western Forest Products Lab., Vancouver (British Columbia).
ENERGY SELF-SUFFICIENCY PROSPECTS FOR THE BRITISH COLUMBIA FOREST PRODUCTS INDUSTRY
R. S. Evans Apr. 1977 23 p refs
(VP-X-166) Avail: NTIS HC A02/MF A01

The analysis indicates that in each of the sub-zones, the industry could be independent of natural gas, and that a net residue surplus would still remain in four sub-zones sufficient to sustain thermal-electric-generating plants with an aggregate capacity of 175 megawatts. New or improved technologies for recovery of energy from hog fuel are identified. Wood gasification offers the greatest potential for replacing natural gas. Author

N77-24592*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF A BREADBOARD HEAT AND PRODUCT-WATER REMOVAL SYSTEM FOR A SPACE-POWER FUEL CELL DESIGNED WITH STATIC WATER REMOVAL AND EVAPORATIVE COOLING
Norman H. Hagedorn and Paul R. Prokipius Washington May 1977 27 p ref
(NASA-TN-D-8485; E-8822) Avail: NTIS HC A03/MF A01 CSCL 10A

A test program was conducted to evaluate the design of a heat and product-water removal system to be used with fuel cell having static water removal and evaporative cooling. The program, which was conducted on a breadboard version of the system, provided a general assessment of the design in terms of operational integrity and transient stability. This assessment showed that, on the whole, the concept appears to be inherently sound but that in refining this design, several facets will require additional study. These involve interactions between pressure regulators in the pumping loop that occur when they are not correctly matched and the question of whether an ejector is necessary in the system. Author

N77-24593*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD FOR FABRICATING SOLAR CELLS HAVING INTEGRAL COLLECTOR GRIDS Patent Application
John C. Evans, Jr., inventor (to NASA) Filed 6 Jun. 1977 16 p
(NASA-Case-LEW-12819-1; US-Patent-Appl-SN-803823) Avail: NTIS HC A02/MF A01 CSCL 10A

A heterojunction barrier photovoltaic device is described. It comprises a heterojunction or Schottky barrier device, a conductive base metal layer compatible with and coating predominately the exposed surface of the p-type substrate of the device such that a back surface field region is formed at the interface between the device and the base metal layer, a transparent, conductive mixed metal oxide layer in integral contact with the n-type layer of the heterojunction or Schottky barrier device having a metal alloy grid network of the same metal elements of the oxide constitutents of the mixed metal oxide layer embedded in the mixed metal oxide layer, an insulating layer which prevents electrical contact between the conductive metal base layer and the transparent, conductive metal oxide layer, and a metal contact means coverging the insulating layer and in intimate contact with the metal grid network embedded in the transparent, conductive oxide layer for conducting electrons generated by the photovoltaic process from the device. NASA

N77-24594# Oak Ridge National Lab., Tenn.
PROCESS ENERGY RELIABILITY REQUIREMENTS FOR SELECTED INDUSTRIES
W. G. Sullivan and T. M. West Sep. 1976 58 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5428) Avail: NTIS HC A04/MF A01

Twenty-nine responses to the mail-out questionnaire were returned, and data were analyzed with respect to steam generator characteristics, types of fuels used, amounts of electrical energy purchased or sold, and reliabilities of the steam-supply system. Reliability referred to the percentage of clock time that sufficient amounts of steam energy were available to permit desired production quotas to be met at a particular plant. For the 17 chemical industries, study results showed that reliabilities ranged from 100 to 89 percent, and the average value was 98 percent. The nine petroleum refineries experienced an average steam-supply system reliability of 92 percent, with individual refinery reliabilities ranging from 100 to 70 percent. Finally, there were only three primary metals companies represented in the study, and their process energy reliabilities were 100 percent. ERA

N77-24595# Brookhaven National Lab., Upton, N.Y.
FUTURE NATURAL GAS SUPPLY TO THE NORTHEAST
R. N. Langlois Apr. 1976 77 p refs
(Contract E(30-1)-16)
(BNL-50558) Avail: NTIS HC A05/MF A01

Based on estimates of total U.S. gas reserves (discovered and undiscovered) and applying a modified Hubbert method to a number of assumptions, projections of natural gas production were made for 1985 and 2000. From these, the amount of gas supply available to the Northeast was projected based on further assumptions, e.g., if there is gas deposit on the Atlantic Outer Continental Shelf, whether it will be developed in time, how much of the Alaskan gas is available to this part of the nation, etc. The conclusion is that under most scenarios the supply of natural gas to the Northeast will be severly constrained. ERA

N77-24596# Brookhaven National Lab., Upton, N.Y.
PLANNER'S ENERGY WORKBOOK: A USERS' MANUAL FOR LAND USE AND ENERGY UTILIZATION
1976 23 p Presented at the Am. Inst. of Planners New England Regional Meeting, Hyannis, Mass., 11 Jun. 1976 Prepared in cooperation with State Univ. of New York, Stony Brook
(Contract E(30-1)-16)
(BNL-21546; Conf-760660-1) Avail: NTIS HC A02/MF A01

The analysis of energy demand and fuel consumption in the residential sector, the commercial sector, the industrial sector, and the transportation sector in the U.S. is summarized. Each of the parameters that enter into the analysis is described for each sector. ERA

N77-24597# Brookhaven National Lab., Upton, N.Y.
ALTERNATIVE PATTERNS OF INDUSTRIAL ENERGY CONSUMPTION IN THE NORTHEAST
R. J. Gottle, IV Mar. 1976 61 p refs
(Contract E(30-1)-16)
(BNL-50555) Avail: NTIS HC A04/MF A01

Data sources, assumptions, and methodology employed to construct the 1972 industrial energy consumption in the region are discussed. Utilizing this base-year information and existing projections and assumptions of underlying economic phenomena, a number of alternative energy-consumption patterns were calculated for the northeastern industrial sector in the years 1985 and 2000. ERA

N77-24598# Oak Ridge National Lab., Tenn.
ELECTROSTATIC ENERGY STORAGE
R. L. Macklin Sep. 1976 9 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5529) Avail: NTIS HC A02/MF A01

The advantages of capacitor storage of energy, particularly for automotive use, are reviewed and compared with alternatives. A few suggestions for research possibilities for possibly suitable organic dielectrics are given. ERA

N77-24599# Oak Ridge National Lab., Tenn.
ANNUAL CYCLE ENERGY SYSTEM: INITIAL INVESTIGATIONS

H. C. Fischer, J. C. Christian, E. C. Hise, A. S. Holman, A. J. Miller, W. R. Mixon, J. C. Moyers, and E. A. Nephew Oct. 1976 65 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5525) Avail: NTIS HC A04/MF A01

Initial analytical and experimental investigations were conducted to establish data and design procedures prior to a demonstration of the Annual Cycle Energy System (ACES) in an actual building. ACES is an integrated system for supplying space heating and cooling, and domestic hot water to a building through the use of a heat pump, a thermal storage unit, and an outdoor radiative/convective panel. The heat pump extracts energy from a tank of stored water to provide winter heating. The ice that is formed is accumulated for subsequent use in meeting the cooling requirements of the building in the summer. A components test assembly was constructed to measure the rates of heat transfer during ice buildup and brine operations, to assess the design requirements of the evaporator and the desuperheater for producing domestic hot water. ERA

N77-24600# Owens-Illinois, Inc., Toledo, Ohio.
EVALUATION OF AN ALL-GLASS, EVACUATED, TUBULAR, NON-FOCUSING, NON-TRACKING SOLAR COLLECTOR ARRAY
1976 44 p
(Contract E(11-1)-2919)
(TID-27192) Avail: NTIS HC A03/MF A01

An evaluation of an advanced design evacuated tubular all-glass solar collector using air as the heat transfer fluid and having the potential of producing an exit fluid temperature in excess of 250 F at an efficiency of greater than 40 percent is presented. The test systems are operated over a wide range of mass flow rates and inlet temperatures under selected steady state conditions. In addition, the systems are operated in a control mode simulating an air conditioning cycle. ERA

N77-24601# California Univ., Livermore. Lawrence Livermore Lab.
RESEARCH LEADING TO THE PRODUCTION AND EARLY USE OF NUMERIC DATA BANKS OF MATERIAL PROPERTIES AND SYSTEM ANALYSES Quarterly Progress Report, Apr. - Jun. 1976
Viktor E. Hampel 16 Sep. 1976 31 p refs
(Contract W-7405-eng-48)
(UCRL-50038-76-2) Avail: NTIS HC A03/MF A01

A bibliographic data base for flywheel energy-storage systems was created. Work was continued on the systems structure for the energy-storage data bases. A test of this prototype data-base structure was begun for data on properties of salts used in thermal storage systems. Preliminary definitions were developed for data bases to permit the analysis and intercomparison of energy-storage systems. ERA

N77-24602*# Rasor Associates, Inc., Sunnyvale, Calif.
ADVANCED THERMIONIC ENERGY CONVERSION: JOINT HIGHLIGHTS Status Report
May 1976 22 p
(Contracts NAS3-19861; E(11-1)-2263)
(NASA-CR-152955; TID-27200) Avail: NTIS HC A02/MF A01 CSCL 10A

A theoretical model was used to study the effects of structured electrodes on converter I-V characteristics and results are given. An auxiliary-ion-source triode operated as a plasmatron was used for studying the enhancement distribution and magnetic effects, and results are reported. Design features of the high current-zero power (ZEPO) converter tests are given. ERA

N77-24603# Waterloo Univ. (Ontario).
WATSUN: A SOLAR HEATING SIMULATION AND ECONOMIC EVALUATION PROGRAM User's Manual
J. F. Orgill and K. G. T. Hollands Apr. 1976 88 p refs
(NP-21307) Avail: NTIS (US Sales Only) HC A05/MF A01; ERDA Depository Libraries

The modules contained within WATSUN consist of system rather than component models with the exception of an optional flat-plate collector model. The result of using system rather than component models is reduced computational effort and associated costs allowing for the evaluation of a wide range of system sizes. ERA

N77-24604# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
PROGRESS REPORT ON THE PERFORMANCE OF THREE AUSTRALIAN SOLAR HOT WATER SYSTEMS
H. Salt Sep. 1976 29 p refs
(SES-8) Avail: NTIS (US Sales Only) HC A03/MF A01; ERDA Depository Libraries

Three Australian hot water systems were monitored. These systems are of different areas, and the hot water usage patterns at the three installations are very different. The systems are described and tables are presented showing the energy consumed in providing the hot water, the fraction of this which was provided by the solar part of the system and the efficiency with which the system was able to convert the solar radiation incident on the collectors to hot water required by the users. The tables show that the hot water usage pattern plays a significant part in determining the overall solar system performance. ERA

N77-24605# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
OCEAN THERMAL ENERGY CONVERSION PROGRAM. EPFFEP PROGRAM FOR OTEC STRUCTURAL SYSTEMS
H. Suzuki and W. F. Chen 1976 133 p refs
(Contract E(11-1)-2682)
(COO-2682-8) Avail: NTIS HC A07/MF A01

In the analysis of suboceanic structures such as the large shells proposed for adoption in the Ocean Thermal Energy Conversion program (OTEC); a corresponding computer code called EPFFEP (Elastic Plastic Fracture Finite Element Program) is developed here to reflect this material response. The details of this program and its implementation on the computer system CDC 6400 are described. All the input and output of the program along with an example illustrating a typical application of EPFFEP modeling are included. A computer algorithm for the constitutive relations of concrete is also given in the form of flow charts. ERA

N77-24606# California Univ., Livermore. Lawrence Livermore Lab. Div. of Solar Energy.
UNITED STATES SPECIAL FORMAT REPORT: PERFORMANCE OF THE SOHIO SOLAR WATER HEATING SYSTEM USING LARGE AREA PLASTIC COLLECTORS (GRANTS, NEW MEXICO)
W. C. Dickinson May 1976 39 p refs
(Contract E(04-3)-1038)
(SAN-1038-76-1) Avail: NTIS HC A02/MF A01

Performance measurements have been made with this system over a period of about one year. Plans and specifications have just been completed for a full-sized system consisting of 72 SSP (Sohio Solar Power) modules, each 3.5 m by 60 m. ERA

N77-24607# California Univ., Berkeley. Lawrence Berkeley Lab.
PRELIMINARY EVALUATION OF HYBRID ELECTROCHEMICAL-THERMOCHEMICAL CYCLES FOR THE PRODUCTION OF HYDROGEN FROM WATER M.S. Thesis
David Herbert Munger Aug. 1976 90 p refs
(Contract W-7405-eng-48)
(LBL-5477) Avail: NTIS HC A05/MF A01

Certain physical and economic limitations of hybrid cycles are identified and discussed. The major problems facing the hybrid processes are the short supply and expense of the reactant material, high solubility of the anodic reactant (or product), incomplete reactions, difficult material handling, poor heat exchange characteristics, and difficult filtration due to degradation of the solid material. Although the hybrid cycles presented in this study are theoretically equal or superior to the other methods for water decomposition, their technological feasibility and economic promise are, nevertheless, not sufficient to contemplate their practical implementation. ERA

N77-24608# Natural Dynamics, Des Moines, Iowa.
FAST PRODUCTION OF METHANE BY ANAEROBIC DIGESTION Progress Report, 24 Jul. - 23 Aug. 1976
C. D. Finney, R. S. Evans, II, and K. A. Finney Sep. 1976 12 p refs
(Contract E(11-1)-2900)
(COO-2900-3) Avail: NTIS HC A02/MF A01

Optimum loading and gas production as a function of the low viscosity and pressure, and high temperature were investigated. In a preliminary experiment in which all of the parameters were optimized, a stable glucose loading rate of 1.81 lb cubic foot was achieved. This value defines the state-of-the-art since it is 2.1 times greater than the prior art value. By tuning the temperature, mixing, and residence time parameters, an acceptable energy efficiency can probably be achieved. ERA

N77-24609# Institute of Gas Technology, Chicago, Ill.
MOLTEN SALT THERMAL ENERGY STORAGE SYSTEMS: SALT SELECTION
H. C. Maru, H. F. Dullea, and V. S. Huang Aug. 1976 61 p refs
(Contract E(11-1)-2888)
(COO-2888-1) Avail: NTIS HC A04/MF A01

A total of 31 inorganic salts and salt mixtures, including 9 alkali and alkaline earth carbonate mixtures, were evaluated for their suitability as heat-of-fusion thermal energy storage materials at temperatures of 850 to 1000 F. Thermophysical properties, safety hazards, corrosion, and cost of these salts were compared on a common basis. It is concluded that because alkali carbonate mixtures show high thermal conductivity, low volumetric expansion on melting, low corrosivity and good stability, they are attractive as heat-of-fusion storage materials in this temperature range. ERA

N77-24610# Reynolds, Smith and Hills, Jacksonville, Fla.
LIFE CYCLE COSTING EMPHASIZING ENERGY CONSERVATION: GUIDELINES FOR INVESTMENT ANALYSIS
Sep. 1976 126 p refs
(Contract E(49-1)-3850)
(ERDA-76/130) Avail: NTIS HC A07/MF A01

This guidebook provides applicable study parameters for capital expenditures emphasizing energy conservation. These parameters quantify such features as discount rates, energy escalation rates, study period, salvage value, Btu measurement, and analysis techniques. By using these analysis concepts, budget requests for energy conservation programs will be standardized and result in a common measurement basis. The format and measurement statistics requested allow a comparable ranking of budget contenders, thus assuring maximum benefit for the funds expended. The guidebook also serves to allow the magnitude and complexity of each individual project to dictate the level of analysis required. ERA

N77-24611# Waterloo Univ. (Ontario).
DETERMINING THE TECHNICAL AND ECONOMIC FEASIBILITY OF UTILIZING SOLAR ENERGY FOR HEATING BUILDINGS IN CANADA Yearly Report, Project No. 4107
K. G. T. Hollands and J. F. Orgill Apr. 1976 47 p refs
Sponsored by National Research Council, Canada
(NP-21308) Avail: NTIS (US Sales Only) HC A03/MF A01; ERDA Depository Libraries

The development of a computer model for solar heating systems and development of a method for utilizing incomplete solar data are presented. ERA

N77-24612# Argonne National Lab., Ill.
ELECTRIC STORAGE HEATING: THE EXPERIENCE IN ENGLAND AND WALES AND IN THE FEDERAL REPUBLIC OF GERMANY
J. G. Asbury and A. Kouvalis May 1976 30 p refs
(Contract W-31-109-eng-38)
(ANL/ES-50) Avail: NTIS HC A03/MF A01

The policies, methods, and circumstances under which electric storage heating was commercialized in Europe are reviewed, and background information for evaluating the feasibility of commerical applications in the United States is given. ERA

N77-24613# California Univ., Livermore. Lawrence Livermore Lab.
ANODIC BEHAVIOR OF LITHIUM IN AQUEOUS LITHIUM HYDROXIDE SOLUTIONS
J. F. Cooper, P. K. Hosmer, and R. V. Homsy 17 Oct. 1976 22 p Presented at Electrochemical Soc. Meeting, Las Vegas, Nev., 17 Oct. 1976
(Contract W-7405-eng-48)
(UCRL-78156; Conf-761057) Avail: NTIS HC A02/MF A01

Electrode polarization and coulombic efficiency were measured as a function of flow rate, current density and electrolyte concentration. The applicability of the plane-parallel electrode configuration for batteries of the lithium water type was evaluated. Current efficiencies of less than one indicated that the Li anode was partially consumed in a corrosion reaction which contributes no net current to the external circuit. It was found that the critical current density is the diffusion-limited anodic current density. The following conclusions were drawn: the Li electrode shows a linear polarization behavior up to a diffusion-limited current; in this linear region the rate of Li dissolution is relatively constant; as the external current is increased, the corrosion current falls off -- a linear dependence of coulombic efficiency on external current results; and the plane parallel configuration seems fully suitable. ERA

N77-24614# United Technologies Corp., Farmington, Conn. Power Systems Div.
DEVELOPMENT OF HIGH-TEMPERATURE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATE, PHASE 1 Quarterly Technical Progress Report, Jun. - Aug. 1976
N. G. Carlson Sep. 1976 109 p refs
(Contract E(49-18)-2292)
(FE-2292-4; QTPR-1) Avail: NTIS HC A07/MF A01

Parametric analyses were conducted for identification of systems and equipment and the results have shown the preliminary performance of various gas-turbine engines and steam bottoming cycle systems operating in conjunction with a molten-salt gasifier. A preliminary heat and mass-balance analysis for a power system has indicated an overall efficiency rate of nearly 43 percent. Off-design performance of the gasifier, gas-turbine, and steam bottoming cycle has been defined. Analysis of transient operating modes and identification of control requirements has been started. Effort is being aimed at defining the open-cycle gas-turbine engine, including the effects of various engine components on combined-cycle system performance. ERA

N77-24615# European Space Agency, Paris (France).
THE CYLINDRICAL PARABOLIC MIRROR AS REFLECTOR FOR SOLAR COLLECTORS-EFFICIENCIES AND OPTIMIZATION
Rainer Koehne Apr. 1977 50 p refs Transl. into ENGLISH of 'Der parabolische Zylinderspiegel als Reflektor fuer Solarkollektoren Wirkungsgrade u. Optimierungsbetrachtungen', DFVLR, Stuttgart Report DLR-FB-76-55, 27 Oct. 1976 Original report in GERMAN previously announced as N77-20607 Original German report available from DFVLR, Cologne DM 15.90
(ESA-TT-365; DLR-FB-76-55) Avail: NTIS HC A03/MF A01

After introducing the concentration ratio and intercept-factor of focusing collectors with parabolic cylinder mirrors the energy balance equations were derived to determine the efficiencies under steady state conditions. The components of the collector were varied and optimized with respect to maximum efficiency. Furthermore the dynamic behavior of the collector was calculated and the average efficiencies compared with the efficiencies in the steady state condition. Author (ESA)

N77-24616# Federal Energy Administration, Washington, D. C. Office of Energy Conservation and Environment.
SECOND QUARTERLY REPORT TO US HOUSE AND SENATE COMMITTEES ON APPROPRIATIONS
Jul. 1976 35 p refs
(PB-263418/6; FEA/D-77/045) Avail: NTIS HC A03/MF A01 CSCL 10A

Progress of the Federal Energy Administration (FEA) energy conservation programs and short and long term accomplishments is described. An overview briefly summarizing the programs, focusing on new programs and significant changes in the scope of existing programs is included. Highlights of the current status of the programs, including indicators of energy consumption and conservation and major activities conducted during the reporting period are given, and new publications are listed. Autnor

N77-24617# California Univ., Los Angeles. Dept. of Energy and Kinetics.
A METHOD FOR THE DETERMINATION OF THE EQUATION

OF THE STATE OF ADVANCED FUELS BASED ON THE PROPERTIES OF NORMAL FLUIDS
Myron J. Hecht Feb. 1977 115 p refs
(Contract AT(49-24)-0246)
(PB-263889/8; UCLA-ENG-76-122; NUREG-0177) Avail: NTIS HC A061/MF A01 CSCL 07D

An equation of state based on the properties of normal fluids, the law of rectilinear averages, and the second law of thermodynamics can be derived for advanced fuels on the basis of the vapor pressure, enthalpy of vaporization, change in heat capacity upon vaporization, and liquid density at the melting point. The method consists of estimating an equation of state by means of the law of rectilinear averages and the second law of thermodynamics, integrating by means of the second law until an instability is reached, and then extrapolating by means of a self-consistent estimation of the enthalpy of vaporization. GRA

N77-24618# UOP, Inc., Des Plaines, Ill.
OPTIMIZATION OF PT-DOPED KOCITE (R) TRADEMARK ELECTRODES IN H3 PO4 FUEL CELLS Interim Progress Report, Feb. - Aug. 1976
R. N. Leverle Oct. 1976 58 p refs
(Contract DAAG53-76-C-0014; DA Proj. 1G7-62708-AH-67) (AD-A034604) Avail: NTIS HC A04/MF A01 CSCL 10/2

The use of UOP Pt-impregnated Kocite materials as low cost air and/or fuel electrocatalysts in phosphoric acid electrolyte fuel cells is being optimized. Kocite(R) materials are composite structures consisting of pyropolymers chemically bonded to refractory substrates. Fuel cell electrodes are fabricated from those materials and tested as anodes or cathodes in model fuel cells with Teflon bonded Pt black counter electrodes. Kocite is being produced in 200-400 gram quantities from a high surface area alumina with a particle size of about 500 nm. From the Pt-impregnated Kocite, electrodes with a porous graphite paper current collector are being fabricated by both hand and machine calendering operations with 0.125, 0.25, and 0.50 mg/sq cm Pt loadings. When tested in model phosphoric acid fuel cells with 2 mg/sq cm Pt black counter electrodes, full-cell IR-free performances of 0.62 and 0.71 volts as air and oxygen cathodes, respectively, have been obtained at 100 ma/sq cm and 149 C using 0.25 mg/sq cm Pt-loaded Kocite electrodes. Lifetime testing of Kocite electrodes as cathodes indicates no catalyst deterioration occurs for periods in excess of 500 hours for temperatures from 140 to 180 C. In order to optimize the structure of Kocite electrodes, the teflon content, density, and thickness of the Kocite catalyst layer have been systematically varied. GRA

N77-24619# Stanford Univ., Calif. Systems Optimization Lab.
ENERGY MODELS AND LARGE-SCALE SYSTEMS OPTIMIZATION
George B. Dantzig and Shailendra C. Parikh Nov. 1976 11 p refs
(Contracts N00014-75-C-0267; N00014-75-C-0865)
(AD-A033736; SU-SOL-76-23) Avail: NTIS HC A02/MF A01 CSCL 12/2

The optimization of large-scale dynamic systems represents a central area of research whose successful outcome could make important contributions to the analysis of crucial national and world problems. Although a great number of papers have been published on the theory of solving large-scale systems, not much in software exists that can successfully solve such systems. It is believed that there has been little progress, because there has been little in the way of extensive experimentation comparing methods under laboratory-like conditions on representative models. At Stanford's Systems Optimization Laboratory (SOL), to bridge this gap between theory and application, experimental software for solving large-scale dynamic systems has been developed, proposed techniques on representative models have been systematically compared, and information regarding experimental results has been recorded and disseminated. This report gives an overview of some of the work being done at the Systems Optimization Laboratory. GRA

N77-24620# Societal Analytics Inst., Inc., Dallas, Tex.
BARRIERS TO THE USE OF WIND ENERGY MACHINES: THE PRESENT LEGAL/REGULATORY REGIME AND A PRELIMINARY ASSESSMENT OF SOME LEGAL/POLITICAL/SOCIETAL PROBLEMS
Rita Falk Taubenfeld and Howard J. Taubenfeld Jul. 1976 159 p refs
(Grant NSF AER-75-18362)
(PB-263576/1; NSF/RA-760422) Avail: NTIS HC A08/MF A01 CSCL 10B

The present state of law and regulation at all levels of government that may affect wind energy machines is analyzed. Also analyzed and assessed is the state of analogous and related law and regulation, requirements at various levels of government, and international rules, as wind machines grow larger and/or are used in arrays. It suggests some potential impacts of the development of wind-based power technology on selected aspects of the American economy, particularly on the energy delivering utilities. GRA

N77-24621# Transportation Systems Center, Cambridge, Mass.
THE BURN-OFF OF WASTE LUBRICATING OILS IN COAST GUARD POWERPLANTS: EXECUTIVE SUMMARY
J. R. Sherrard and R. A. Walter Aug. 1976 13 p refs Sponsored in part by the Coast Guard
(AD-A034180; USCG-D-113-76) Avail: NTIS HC A02/MF A01 CSCL 21/4

This report summarizes the results of a study to investigate the feasibility of utilizing waste lubricating oils as fuel in Coast Guard powerplants. Adoption of this practice by the Coast Guard would conserve diesel fuel, as well as minimizing environmental degradation and eliminating costs associated with lube oil disposal. It was concluded that the Coast Guard can safely use this lube oil as fuel if it is properly filtered and mixed at the correct ratios with the fuel oil. Various filtering devices were tested and the correct mix ratios for diesel engines, boilers, and gas turbines were determined. It was found that with these safeguards the practice of lube oil burn-off will not adversely affect engine emissions, performance, maintenance, or wear characteristics. Final recommendations and conclusions were made to the Coast Guard for the adoption of this practice. Author (GRA)

N77-24622# Mitre Corp., McLean, Va.
SOLAR ENERGY GOVERNMENT BUILDINGS PROGRAM POLICY AND IMPLEMENTATION PLAN
Jan. 1977 232 p refs
(Contract FEA-CR-05-60704-00)
(PB-262841/0; FEA/D-77/032) Avail: NTIS HC A11/MF A01 CSCL 13A

The costs and benefits of several feasible scales of implementation of such a program to support the decision as to whether the program should be implemented, and if so, at what level, are discussed. Several alternative administrative arrangements for implementing the program if approved are presented. GRA

N77-24623# TRW Defense and Space Systems Group, Redondo Beach, Calif. Propulsion and Combustion System Dept.
STUDY ON ELECTROFLUID DYNAMIC POWER GENERATION Final Technical Report, 23 Apr. 1973 - 23 Jan. 1976
M. N. Hubberman, H. Shelton, W. Krieve, and C. L. Dailey Wright-Patterson AFB, Ohio AFAPL Jul. 1976 116 p refs
(Contract F33615-75-C-4085)
(AD-A033729; AFAPL-TR-76-31) Avail: NTIS HC A06/MF A01 CSCL 10/2

A three-year program to develop and advance Electrofluid Dynamic (EFD) Power Generation technology is described. A range of axisymmetric EFD channel sizes from 1/12 inch operating with inlet pressures of 700 psig to the 1/48 inch channel designed to operate with 3,000 psig were experimentally studied. Failure of gas-breakdown scaling laws prevented the designed 70 watts from being achieved with the small sizes at high pressure. Experimental work on the high voltage breakdown of high pressure gases including air, Hydrogen, SF6, Argon, Nitrogen CO2, and mixtures using various Freons shows a degradation of anticipated strength at about 10 to the 8th power V/M. Theoretical analyses and experimental measurements have been made on the droplet size and density in EFD generators using humid air for EFD channel sizes from 1/4 inch to 1/48 inch. Analyses also include nucleation and growth of Mercury and steam. A preliminary design study of the short duration airborne 6 MW

conversion system and a long duration 1 KW and 100 KW ground based system using EFD is included. Author (GRA)

N77-24624# Naval Postgraduate School, Monterey, Calif.
STUDY OF THE CYCLIC PERFORMANCE OF SUBMARINE TYPE LEAD-ACID STORAGE BATTERIES BY EXAMINATION OF THE POSITIVE PLATE STRUCTURES M.S. Thesis
John Louis Pokorny, Jr. Sep. 1976 261 p refs
(AD-A033764) Avail: NTIS HC A12/MF A01 CSCL 10/3

The microstructures of the active material of the positive plate of submarine type storage batteries were studied, using scanning electron microscopy, as the batteries were cycled on a deep cycle routine. It is seen that capacity loss of these batteries can be directly related to the formation of a coralloid structure within the active material of the positive plate in both lead-antimony and lead-calcium grid batteries. It is proposed that this coralloid structure also leads to active material shedding which is observed at the end of the battery life. The ability of thick plate lead-calcium grid batteries to be successfully operated on a deep cycle routine is related to a reserve of active material retained within the positive plate as lead-sulfate, which is eventually transformed into PbO2 to maintain the capacity of the battery. GRA

N77-24625# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
SEALED PRIMARY LITHIUM-INORGANIC ELECTROLYTE CELL Quarterly Report, 1 Jun. - 31 Aug. 1976
A. N. Dey Dec. 1976 46 p refs
(Contract DAAB07-74-C-0109)
(AD-A034069; ECOM-74-0109-10; QR-10) Avail: NTIS HC A03/MF A01 CSCL 10/3

The Li/SOCl2 hermetic D cell developed by P. R. Mallory and Co. Inc. met or exceeded all the initial objectives such as E. D. of 150 WHr/lb at thrity hours rate and a peak power density of 50 watts/lb and the storage and operating temperature of -40 to 160 C. The two major deficiencies exhibited by the cells were explosion hazard on abuse and voltage delay on storage. Both the problems were studied in detail and considerable progress has been made in both the above areas. During the last quarter. The SEM studies of the Li that was found to be responsible for the voltage delay were continued. LiCl film growth rate curves for the Li samples stored in the electrolytes containing various salt concentrations and additives at 72, 55, and 25 C were obtained. The growth rates were substantially reduced by reducing the salt concentration. Also the addition of SO2 caused the LiCl film to grow in a more orderly fashion. Examination of the effect of these electrolyte variables on the voltage delay of the practical hermetic Li/SOCl2D cells during the next quarter is planned. A DTA apparatus for doing differential thermal analysis of the various chemicals present in a fresh and/or partially discharged Li/SOCl2D cell has been set up. Preliminary data obtained so far indicate that it is possible to distinguish between pressure bursts and a thermal runaway by this method. GRA

N77-24626# Battelle Pacific Northwest Labs., Richland, Wash.
THE USE OF GEOTHERMAL ENERGY AT MILITARY INSTALLATIONS Research Report, 1 Sep. - 15 Oct. 1976
W. R. McSpadden Oct. 1976 71 p refs Sponsored by DARPA
(AD-A034241) Avail: NTIS HC A04/MF A01 CSCL 10/1

This report is a result of a review of eight ARPA funded projects conducted to identify: (1) geothermal resources for military installations and (2) key problems for their development. Of these, four projects dealt with identification and evaluation of resources; two dealt with problems associated with the chemistry of geothermal fluids, in particular corrosion and scaling; one project was concerned with the critical problem of drilling for geothermal resources; and one was a review of the current state-of-the-art of geothermal energy development. As a result of these studies, two target areas have been identified as prime candidates for development of geothermal energy at military installations. The Coso Hot Springs, on the Naval Weapons Center at China Lake, CA, and the Marine Corps base at Twenty-nine Palms, CA. In addition, two test sites are proposed in southern Texas for research and development of geopressured systems. As of the beginning of FY 77, the Coso Geothermal Site is under active exploration and development with research funding from ERDA. The objectives of these eight ARPA funded research projects have been accomplished. GRA

N77-24627# Office of Naval Research, London (England).
INTERNATIONAL SYMPOSIUM ON WIND ENERGY SYSTEMS
Robert H. Nunn 7 Dec. 1976 28 p Conf. held at Cambridge, Engl., 7-9 Sep. 1976
(AD-A034871; ONRY-C-31-76) Avail: NTIS HC A03/MF A01 CSCL 10/1

Vertical- and horizontal-axis systems were discussed both in theory and in practice. Applications ranged from wind forms, each with hundreds of megawatt units, to the use of Cretan windmills to provide water for cattle. Wind energy conversion units have been operated in several configurations and the theory of their performances is sufficiently advanced to allow design for fabrication. The trends are towards larger units for municipal power systems and smaller units for domestic use. In the former case, the behavior of large wind turbines operating in large arrays, and the output (with and without storage) of several such arrays when geographically dispersed, has yet to be well understood. The field has reached a level of maturity characterized by such factors as economics, environmental impact, and public acceptance. GRA

N77-24628# Boston Univ., Mass. Dept. of Chemistry.
PHOTOCHEMICAL CONVERSION OF SOLAR ENERGY Semiannual Progress Report, 1 Jan. - 30 Jun. 1976
Norman N. Lichtin 28 Oct. 1976 31 p refs
(Grant NSF AER-72-03579-A05)
(PB-262450/0; NSF/RA-760354; NSF/RANN/SE/AER72-03579/A05-76) Avail: NTIS HC A03/MF A01 CSCL 07E

The dependence of the composition and kinetics of decay of the photostationary state of acidic iron-TH(+) solutions on solvent anions and initial concentrations of solutes has been measured and correlated with rates of elementary reactions. Sensitization increases the photostationary concentration of leucothiazine. GRA

N77-24629# Federal Railroad Administration, Washington, D. C. Office of Research and Development.
FUEL EFFICIENCY IMPROVEMENT IN RAIL FREIGHT TRANSPORTATION: MULTIPLE UNIT THROTTLE CONTROL TO CONSERVE FUEL Interim Report
Marilynne E. Jacobs Dec. 1976 31 p
(PB-262470/8; FRA/ORD-76-297) Avail: NTIS HC A02/MF A01 CSCL 13F

From the results of the tests performed on the Kansas City Southern in regular freight service, significant fuel savings were realized by using a semi-automatic throttle control device or fuel saver system to take one or more units of the locomotive consist off line when the available power and tractive effort exceeded the demand. This procedure effectively lowered the horsepower per ton ratio of the train and decreased the rate of fuel consumption. GRA

N77-24630# North Carolina Univ., Chapel Hill. Materials Research Center.
FUEL CELLS AND SOLID ELECTROLYTES Final Report, 1 Jun. 1975 - 30 Sep. 1976
Thomas J. Meyer, Royce W. Murray, Sang-Il Choi, and Thomas L. Isenhour 30 Oct. 1976 142 p refs
(Grant DAHC04-75-G-0144; ARPA Order 3005)
(AD-A033782; ARO-13067.1-A-C) Avail: NTIS HC A07/MF A01 CSCL 07/4

This report recounts results on four diverse topics: (1) homogeneous catalysis of net electrochemical reactions as applied to fuel cells; (2) electrocatalysis: application of X-ray photoelectron spectroscopy to surface composition of electrode materials; (3) theoretical investigation of solid electrolytes; and (4) application of machine decisions to failure analysis. Author (GRA)

N77-24631# Temple, Barker and Sloane, Inc., Wellesley Hills, Mass.
STUDY OF THE ELECTRIC UTILITY INDUSTRY DEMAND, COSTS, AND RATES
Jul. 1976 402 p refs

(Contract DI-14-01-0001-1899)
(PB-262843/6; FEA/D-76/289) Avail: NTIS HC A18/MF A01 CSCL 05C

Trends in the demand and costs for the electric utility industry are documented. The potential benefits of a shift to alternative rate structures that might help reshape the patterns of demand growth are examined. GRA

N77-24632# American Univ., Washington, D.C.
RESEARCH ON ELECTROCHEMICAL ENERGY CONVERSION SYSTEMS Final Technical Report, 1 Jul. 1975 - 30 Jun. 1976
Alayne A. Adams and Robert T. Foley Jul. 1976 34 p refs
(Contract DAAG53-76-C-0001; DA Proj. 1T1-61102-A-34A)
(AD-A034454) Avail: NTIS HC A03/MF A01 CSCL 07/4

The project on electrochemical energy conversion system has involved two tasks: the determination of the electrochemical behavior of low molecular weight hydrocarbons and alcohols as well as other possible fuels in aqueous trifluoromethanesulfonic acid and the examination of the electro-chemical interaction of fuel cell reactants with platinum surfaces in aqueous trifluoromethanesulfonic acid. The order of reactivity for low molecular weight alkanes was determined to be C3H8 greater than C2H6 greater than n-C4H10 greater than CH4 in trifluoromethanesulfonic acid monohydrate. The same reaction order had been established previously for low molecular weight alkanes in inorganic acids such as HF, H2SO4, and H3PO4. In the case of each alkane the electrochemical activity in the sulfonic acid was significantly greater than that in phosphoric acid under the same conditions. The electrooxidation of each alkane was evaluated over the temperature range from 95 C to 135 C. The experimental data collected during this reporting period confirm the previous finding that trifluoromethanesulfonic acid monohydrate represents an improved electrolyte for the hydrocarbon-air fuel cell.
Author (GRA)

N77-24633# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Nuclear and Alternative Energy Systems.
REPORT OF THE NATIONAL RESEARCH COUNCIL COMMITTEE ON NUCLEAR AND ALTERNATIVE ENERGY SYSTEMS
21 Jan. 1977 60 p
(Contract EX-76-C-10-3784)
(PB-263595/1) Avail: NTIS HC A04/MF A01 CSCL 18I

The nation's energy future was studied with special consideration of the role of nuclear power in the context of alternative energy systems. Appropriate roles of nuclear and alternative energy systems in the nation's energy future, with a focus on the period between 1985 and 2010, are described. Energy conservation and demand, supply and delivery systems, risks and impacts of various delivery and end-use systems, and alternative future energy scenarios are considered. GRA

N77-24634# General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
ROLE OF THE HEAT STORAGE WELL FUTURE U.S. ENERGY SYSTEMS
Charles F. Meyer, Walter Hausz, Bonnie L. Ayres, and Helen M. Ingram Sep. 1976 188 p refs
(Contracts DI-14-31-0001-4210; DI-14-31-0001-5223)
(PB-263480/6; GE76TMP-27; W77-04145;
OWRT-C-5205(4210)(5)) Avail: NTIS HC A09/MF A01 CSCL 10A

Energy to be conserved is principally that now wasted in generating electricity and in burning fossil fuels for space heating. Results of a study of technical, economic, institutional, environmental, and legal aspects of implementation are reported. GRA

N77-24635# Oklahoma Univ., Norman. Science and Public Policy Program.
OUR ENERGY FUTURE: THE ROLE OF RESEARCH, DEVELOPMENT, AND DEMONSTRATION IN REACHING A NATIONAL CONSENSUS ON ENERGY SUPPLY
Don E. Kash, Michael D. Devine, James B. Freim, Martha W. Gilliland, and Robert W. Rycroft 1976 509 p refs
(Grant NSF SIA-74-17866)
(PB-263761/9; NSF/RA-760158) Avail: NTIS HC A22/MF A01 CSCL 10A

The role of research, development, and demonstration (RD and D) in increasing the supply of energy from the domestic resources of the United States is analyzed. Part 1 describes the context of the study--the nature of the problem, the research team's conception of RD and D, and the institutions that conduct and use RD and D. Part 2 delineates constraints on increased energy supplies from domestic resources and identifies five-year RD and D efforts that can contibute to resolving those constraints. Part 3 present recommendations for priority RD and D funding and procedures for assuring that the RD and D efforts contribute as much as possible to removing the constraints on supply. GRA

N77-24636# Bureau of Mines, Washington, D.C. Div. of Interfuels Studies.
FUELS AND ENERGY DATA: UNITED STATES BY STATES AND CENSUS DIVISIONS, 1973
Lulie H. Crump Dec. 1976 121 p refs
(PB-262362/7; BM-IC-8722) Avail: NTIS HC A06/MF A01 CSCL 21D

Salient information on reserves, production, and consumption of fuels and energy by State is summarized. Reserve and production data are shown for each of the fossil fuels (coal, crude oil, natural gas liquids, and natural gas) and for uranium. The consumption data of each of the major consuming sectors (household-commercial, industrial, transportation, electric power, and miscellaneous) are broken down by energy source (coal, petroleum, natural gas, hydropower, and nuclear). In addition, total energy consumption in the Nation in 1973 is compared with consumption in 1972 and 1974. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-24637 British Library Lending Div., Boston Spa (England).
EXAMINATION OF AIR IMPURITIES AT HEIGHTS UP TO 500 M ABOVE INDUSTRIAL AREAS
L. Rohrschneider, A. Jaeschke, and W. Kubik 28 Oct. 1976 18 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (West Ger.), v. 43, no. 18, 1971 p 1010-1017
(BLL-DRIC-Trans-4753-(3623.66)) Avail: British Library Lending Div., Boston Spa, Engl.

A sampling technique was developed together with a gas chromatographic method for the analysis of air impurities above the ground, in which air is condensed using liquid nitrogen. Air samples were taken at heights of 100 to 500 m using a captive balloon and these were tested for C2 to C6 hydrocarbons, methyl chloride, and vinyl chloride in the ppb range. The amount and type of components found depend very much on the wind direction. The average concentration of most of the impurities found decreases with increasing height. Author

N77-24638*# Douglas Aircraft Co., Inc., Long Beach, Calif.
AIRCRAFT COMMUNITY NOISE IMPACT STUDIES
Jan. 1977 85 p refs
(Contract NAS1-14488)
(NASA-CR-145152) Avail: NTIS HC A05/MF A01 CSCL 13B

The objectives of the study are to: (1) conduct a program to determine the community noise impact of advanced technology engines when installed in a supersonic aircraft, (2) determine the potential reduction of community noise by flight operational techniques for the study aircraft, (3) estimate the community noise impact of the study aircraft powered by suppressed turbojet engines and by advanced duct heating turbofan engines, and (4) compare the impact of the two supersonic designs with that of conventional commercial DC-8 aircraft. Author

N77-24639*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF DIFFENTIAL ABSORPTION LIDAR TECHNIQUE FOR MEASUREMENTS OF ANHYDROUS HYDROGEN CHLORIDE FROM SOLID ROCKET MOTORS USING A DEUTERIUM FLUORIDE LASER

Clayton H. Bair and Frank Allario Washington May 1977 44 p refs
(NASA-TN-D-8390; L-11144) Avail: NTIS HC A03/MF A01 CSCL 13B

An active optical technique (differential absorption lidar (DIAL)) for detecting, ranging and quantifying the concentration of anhydrous HCl contained in the ground cloud emitted by solid rocket motors (SRM) is evaluated. Results are presented of an experiment in which absorption coefficients of HCl were measured for several deuterium fluoride (DF) laser transitions demonstrating for the first time that a close overlap exists between the 2-1 P(3) vibrational transition of the DF laser and the 1-0 P(6) absorption line of HCl, with an absorption coefficient of 5.64 (atm-cm) to the -1 power. These measurements show that the DF laser can be an appropriate radiation source for detecting HCl in a DIAL technique. Development of a mathematical computer model to predict the sensitivity of DIAL for detecting anhydrous HCl in the ground cloud is outlined, and results that assume a commercially available DF laser as the radiation source are presented. Author

N77-24640*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE DATA FOR A TWIN-ENGINE COMMERCIAL JET AIRCRAFT FLYING CONVENTIONAL, STEEP, AND TWO-SEGMENT APPROACHES
Earl C. Hastings, Jr., Arnold W. Mueller, and John R. Hamilton, (Integrated Services, Inc., Hampton, Va.) Washington May 1977 37 p refs
(NASA-TN-D-8441; L-11303) Avail: NTIS HC A03/MF A01 CSCL 20A

Center-line noise measurements of a twin-engine commercial jet aircraft were made during steep landing approach profiles, and during two-segment approach profiles for comparison with similar measurements made during conventional approaches. The steep and two-segment approaches showed significant noise reductions when compared with the -3 deg base line. The measured noise data were also used to develop a method for estimating the noise under the test aircraft at thrust and altitude conditions typical of current landing procedures and of landing procedures under development for the Advanced Air Traffic Control System. Author

N77-24641# California Univ., Berkeley. Lawrence Berkeley Lab.
APPLICATION OF MICROWAVE FABRY-PEROT RESONATORS IN INSTRUMENTATION FOR AIR POLLUTION RESEARCH
H. T. Buscher, B. Leskovar, and W. F. Kolbe 16 Feb. 1976 11 p refs
(Contract W-7405-eng-48)
(LBL-4469) Avail: NTIS HC A02/MF A01

The usefulness of the Fabry-Perot resonator as a sample cell in microwave spectrometer-type gaseous pollution detectors is discussed. The design of a new 70-GHz semiconfocal resonator with variable microwave coupling and wide-range piezoelectric tuning is presented. Experimental data were taken on cavity tuning performance and on the behavior of the variable microwave coupling structure. Theoretically obtained value for the cavity Q-factor is compared with experimental data. ERA

N77-24642# Los Alamos Scientific Lab., N. Mex.
INHOMOGENEOUS ELECTRIC FIELD AIR CLEANER
Burton G. Schuster 1976 15 p refs Presented at the 14th ERDA Air Cleaning Conf., Sun Valley, Idaho, 2-6 Aug. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1538; Conf-760822-11) Avail: NTIS HC A02/MF A01

An expression is derived for the force exerted on a particle in an electrode configuration of two concentric cylinders. Equations of motion are obtained for a particle suspended in a laminar flow of air passing through this geometry. An electrical quadrupole geometry is also examined and shown to be inferior to the cylindrical one. The results of two separate configurations of the single cell prototypes of the proposed air cleaner are described. These tests were designed to evaluate collection efficiencies using mono-disperse polystyrene latex and polydisperse NaCl aerosols. The advantages and problems of such systems in terms of a large scale air cleaning facility will be discussed. ERA

N77-24643# Argonne National Lab., Ill.
ATMOSPHERIC IMPACTS OF EVAPORATIVE COOLING SYSTEMS
J. E. Carson Oct. 1976 48 p refs
(Contract W-31-109-eng-38)
(ANL/ES-53) Avail: NTIS HC A03/MF A01

Known effects of various power plant cooling systems on the atmosphere are reviewed. Evaporative cooling systems create (at least for heat release rates comparable to those of two unit nuclear generating stations) atmospheric changes. For an isolated site such as required for a nuclear power plant, these changes are rather small and local, and usually environmentally acceptable. However, these effects may not remain small as the number of reactors on a given site increases. A critical heat load for a specific site must exist which, if exceeded, can create its own weather patterns, possibly even rain, snow, severe thunderstorms, and tornadoes. Field data are required for the development of mathematical models which can be used to forecast the extent and frequency of the atmospheric effects of a particular heat dissipation system at a particular site. ERA

N77-24644# Midwest Research Inst., Kansas City, Mo.
FINE PARTICLE EMISSIONS INFORMATION SYSTEM USER GUIDE
M. P. Schrag, A. K. Rao, G. S. McMahon, and G. L. Johnson Jun. 1976 232 p refs 2 Vol.
(Contract EPA-68-02-1324)
(PB-262720/6; ERA-600/2-76-172) Avail: NTIS HC A11/MF A01 CSCL 13B

The Fine Particle Emissions Information System (FPEIS) is a computerized information system containing information on primary fine particle emissions to the atmosphere from stationary point sources and evaluations of control devices. The purpose of the system is to provide a centralized source of fine particle measurement information and data for use by engineers and scientists engaged in fine particle control technology development. This document constitutes an extensive user guide to the FPEIS. Detailed instructions for encoding FPEIS data sets are presented, along with a copy of the Standard FPEIS data input forms. Both Off-line and on-line Request procedures for users are explained. GRA

N77-24645# Midwest Research Inst., Kansas City, Mo.
FINE PARTICLE EMISSIONS INFORMATION SYSTEM REFERENCE MANUAL
M. P. Schrag, A. K. Rao, G. S. McMahon, and G. L. Johnson Jun. 1976 82 p refs 2 Vol.
(Contract EPA-68-02-1324)
(PB-262721/4; EPA-600/2-76-173) Avail: NTIS HC A05/MF A01 CSCL 13B

A computerized data base is compiled on primary fine particle emissions to the atmosphere from stationary sources. The data base is a basic reference manual designed to assist engineers and scientists engaged in fine particle control technology development. The FPEIS will contain source test data including particle size distributions; chemical, physical, and bioassay testing results performed on particulate samples; design and typical operating data on particle control systems applied; process descriptions of the sources; and descriptions of the sampling equipment and techniques employed. It identifies and discusses the input data requirements and protocol. For reference, it includes a list of available information request procedures, and describes the general data base management system used to implement the FPEIS. GRA

N77-24646# Office of Water Research and Technology, Washington, D.C. Water Resources Scientific Information Center.
ESTUARINE POLLUTION: A BIBLIOGRAPHY, VOLUME 2
Dec. 1976 579 p 2 Vol.
(PB-263772/6; OWRT/WRSIC-76-207-Vol-2; W77-04109)
Avail: NTIS HC A25/MF A01 CSCL 13B

Selected bibliographies on water pollution of estuaries are presented. I.M.

N77-24647# Office of Water Research and Technology, Washington, D.C. Water Resources Scientific Information Center.
ESTUARINE POLLUTION: A BIBLIOGRAPHY, VOLUME 3
Dec. 1976 570 p refs
(PB-263773/4; OWRT/WRSIC-76-208-Vol-3; W77-04110-Vol-3) Avail: NTIS HC A24/MF A01 CSCL 13B

This issue containing 373 abstracts, is another in a series of planned bibliographies in water resources produced from the information base comprising Selected Water Resources Abstracts (SWRA). Volume 3 covers the period from April 1974 to September 1976. Author and subject indexes are included. GRA

N77-24648# Naval Undersea Center, San Diego, Calif.
SUMMARY REPORT OF THE NAVY CONFERENCE ON ENVIRONMENTAL NOISE
Mar. 1976 56 p Conf. held at Annapolis, 18-20 Nov. 1975 (YF59592001)
(AD-A034051; NUC-TP-520) Avail: NTIS HC A04/MF A01 CSCL 20/1

The Navy Conference on Environmental Noise was held at the Naval Academy, Annapolis, in November 1975 under joint sponsorship of NAVMAT, ONR, and BUMED. The purpose was an in-house review of the Navy's capabilities, plans, programs, and needs in the area of environmental and occupational noise. This general area deals with airborne noise -- its sources (on ships, aircraft, and ashore), its effects on personnel (those in the operational and work environment, and those exposed to Navy noise in the off-station or home environment), and methods for noise abatement. This report summarizes the proceedings, conclusions, and recommendations of the conference. The principal outputs are the recommendations of the four workshops in the areas of (1) medical problems, (2) aircraft noise, (3) shore and community noise, and (4) shipboard noise. The executive summary provides a concise overall review of the conference goals and findings. GRA

N77-24649# Comsis Corp., Glastonbury, Conn. Environmental Services.
OPEN SPACE AS AN AIR RESOURCE MANAGEMENT MEASURE. VOLUME 2: DESIGN CRITERIA Final Report
R. S. DeSanto, R. A. Glaser (David A. Crane and Partners, Inc.), W. P. McMillen, K. A. MacGregor, and J. A. Miller (Yale Univ., New Haven, Conn.) Dec. 1976 183 p refs
(Contract EPA-68-02-2350)
(PB-262678/6; H800-II; EPA-450/3-76-028b) Avail: NTIS HC A09/MF A01 CSCL 13B

A workbook is presented which discusses generalized schemes for the design and location of buffer strips and other forms of open space. Mathematical procedures for combining the appropriate sink factors into four useful carbon monoxide diffusion models are identified. GRA

N77-24650# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
EFFECTS OF HIGH LEVELS OF INORGANIC PHOSPHATE ON AQUATIC ORGANISMS IN PHOSPHATE-RICH ENVIRONMENTS Completion Report
John R. Strange Oct. 1976 123 p refs
(Contract DI-14-31-0001-4071)
(PB-263290/9; ERC-1076; W77-04105; OWRT-B-088-GA(2)) Avail: NTIS CSCL 13B

A technique developed for monitoring basal metabolic function demonstrated increased metabolic rates in the channel catfish with increasing phosphate levels up to concentrations of 10 to 15 mg/l. In a food conversion efficiency study, catfish exposed to 10 mg/l phosphate grew faster than controls. Fish exposed to 20 mg/l fell between the controls and the 10 mg/l group. Although the phosphate-exposed fish grew faster and ate more, their food conversion efficiencies were similar to controls. GRA

N77-24651# Industrial Environmental Research Lab., Research Triangle Park, N. C.
PROCEDURES FOR CASCADE IMPACTOR CALIBRATION AND OPERATION IN PROCESS STREAMS Final Report, Dec. 1975 - Sep. 1976
D. Bruce Harris Jan. 1977 123 p refs
(PB-263623/1; IERL-RTP-236; EPA-600/2-77-004) Avail: NTIS HC A06/MF A01 CSCL 13B

Procedures for measuring particle size which have yielded valid data in stationary sources are presented based on laboratory and field experience. Following these methods should help the users of cascade impactors to obtain the information desired. The preliminary survey, the sampling apparatus, testing procedures, data analysis, calibration procedures, quality assurance, and reporting requirements are discussed. The information applies to cascade impactors in general. Specific commercial impactors are also discussed. GRA

N77-24652# Lawton Planning Dept., Okla.
ENVIRONMENTAL NOISE ASSESSMENT, LAWTON, OKLAHOMA Final Report
Robert M. LaBreche and Michael L. Mendias Apr. 1976 167 p
(PB-263135/6; EPA-906/9-76-002) Avail: NTIS HC A08/MF A01 CSCL 13B

Using a simple methodology employing inexpensive equipment, Lawton, Oklahoma, assessed environmental noise levels in their community. Equivalent sound levels were measured at eleven sites within the city and major sources of noise were identified. The results showed only two areas in Lawton with probable adverse noise impacts, both in the vicinity of local airfields. Small aircraft, automobiles, and helicopters were the most prevalent sources of intrusive environmental noises. Jet aircraft were the most intense. GRA

N77-24653# School of Aerospace Medicine, Brooks AFB, Tex.
LABORATORY AND FIELD EVALUATION OF HYDROGEN CHLORIDE MEASUREMENT INSTRUMENTATION Summary Report, Jun. 1974 - Apr. 1976
Richard L. Miller and Robert C. Ligday Dec. 1976 35 p refs
(AD-A034550; SAM-TR-76-40167164) Avail: NTIS HC A03/MF A01 CSCL 21/8

This report describes the operating characteristics of the microcoulometric and chemiluminescent HCl analyzers and summarizes results from the several laboratory and field evaluation studies. The field test program has provided a clear indication of instrumentation preference for specific applications, but only preliminary insight into the behavior of the exhaust cloud following solid booster rocket launches. The detection concept and fast response characteristics of the chemiluminescent analyzer make it clearly superior for the airborne monitoring application. The coulometer by contrast has proven itself as a versatile laboratory tool and a useful field instrument for HCl detection in ground monitoring applications. Author (GRA)

N77-24654# Systems Sciences, Inc., Chapel Hill, N. C.
SUMMARY OF INFORMATION ON AIR QUALITY NETWORKS AROUND LARGE POINT SOURCES Final Report
Delbert D. Weers and Mark G. Smith Dec. 1976 97 p
(Contract EPA-68-02-1898)
(PB-262978/0; EPA-450/3-77-002) Avail: NTIS HC A05/MF A01 CSCL 13B

A national summary of air quality monitoring networks operated by large point sources is presented. The focus of the report is on five specific industries: electric utilities, primary copper and lead smelting, pulp and paper mills, oil refineries and sulfuric acid plants; and five monitoring parameters: sulfur dioxide, nitrogen dioxide, particulates, sulfates and meteorology. Summaries are reported on a national and EPA regional basis. GRA

N77-24655# Woods Hole Oceanographic Institution, Mass. Marine Policy and Ocean Management Program.
THE EXTENT TO WHICH MARINE TRANSPORTATION WITHIN THE ECONOMIC ZONE WILL BE AFFECTED BY ENFORCEMENT OF THE PROPOSED POLLUTION CONTROLS
Nancy W. Graham Oct. 1976 18 p
(Grant NOAA-04-6-158-44016)
(PB-263397/2; WHOI-76-95; NOAA-76122301) Avail: NTIS HC A02/MF A01 CSCL 13B

The conflict created in the negotiation concerning the content of the regulation results from the differing interests of the maritime powers, states which border on international straits, and other states with a strong interest in protection of the marine environment. The present compromise states that if a violation

is believed to occur in the economic zone, the vessel may be the subject of inquiry; however, it may continue its voyage. Proceedings may be initiated for flagrant violation of international standards which cause major damage or the threat of major damage. However, in most cases physical detention of the vessel may be avoided through action by the flag state.
GRA

N77-24656# Transportation Systems Center, Cambridge, Mass.
AIR QUALITY ANALYSIS OF A MULTILEVEL COMPLEX INTERCHANGE: CASE STUDY USING THE IMPROVED TSC/EPA MODEL Final Report, Oct. - Nov. 1974
Eugene M. Darling, Jr., David S. Prerau, Paul J. Downey, and Jeffrey D. Garlitz Dec. 1976 134 p refs Sponsored by DOT
(PB-262882/4; DOT-TSC-OST-76-35) Avail: NTIS
HC A07/MF A01 CSCL 13B

A description is given of the proposed interchange modifications to a highway air pollution-dispersion model. The details of the air quality analysis for the years 1980 and 1995 are presented. Additional air quality analyses of the site using maximum seeking methods are also discussed. GRA

N77-24657# Minnesota Univ., Minneapolis. Hydraulic Lab.
METHODS FOR SEPARATION OF SEDIMENT FROM STORM WATER AT CONSTRUCTION SITES Final Report
J. F. Ripken, J. M. Killen, and J. S. Gulliver Jan. 1977 102 p refs
(Grant EPA-R-803579)
(PB-262782/6; EPA-600/2-77-033) Avail: NTIS
HC A06/MF A01 CSCL 13B

Limited consideration is given to the settling basin as a primary treatment device, but the principal focus is on the use and characteristics of modern, available, commercial equipment for the secondary treatment process necessary to remove fine mineral solid suspensions. Specific recommendations are made for equipment selection and for additional studies to more clearly characterize these selections for construction site use. GRA

N77-24658# Midwest Research Inst., Kansas City, Mo.
CHEMICAL TECHNOLOGY AND ECONOMICS IN ENVIRONMENTAL PERSPECTIVES. TASK 3: CHLOROFLUOROCARBON EMISSION CONTROL IN SELECTED END-USE APPLICATIONS
Thomas W. Lapp, Ralph R. Wilkinson, Howard Gadberry, and Thomas Weast Nov. 1976 188 p refs
(Contract EPA-68-01-3201)
(PB-262529/1; EPA-560/1-76-009) Avail: NTIS
HC A09/MF A01 CSCL 13B

In applicable areas, the feasibility, cost, and effectiveness of new or modified operating and/or maintenance procedures were studied as a means of reducing emissions. The areas of study were refrigeration and air conditioning, plastic foam blowing agents, and cleaning and drying applications. Actual and potential sources of chlorofluorocarbon emission were identified in each of the three areas. Known methods of emission reduction, efficiencies, and economics are discussed for the fields of refrigeration and air conditioning and for solvent and drying applications. Proposed methods were delineated for the plastic foam blowing agent field. GRA

N77-24659# Index Systems, Inc., Cambridge, Mass.
REVIEW OF AIR DATA SYSTEMS
Dec. 1976 308 p
(Contract EPA-68-01-3308)
(PB-262358/5) Avail: NTIS HC A14/MF A01 CSCL 13B

The major automated data processing requirements and systems operated on behalf of the air pollution control programs of the U.S. Environmental Protection Agency were investigated. Air program information needs, the efficiency and adequacy of current ADP usage to support these needs, and recommended long term policies and short term action steps to reduce ADP costs and improve the quality of ADP services in support of air program data requirements are discussed. GRA

N77-24660# Health Effects Research Lab., Research Triangle Park, N. C. Criteria and Special Studies Office.
THE 2ND ANNUAL CATALYST RESEARCH PROGRAM REPORT: SUMMARY Annual Program Status Report, Jun. 1974 - Dec. 1975
Jan. 1977 83 p
(PB-262696/8; EPA-600/3-77-008) Avail: NTIS
HC A05/MF A01 CSCL 13B

All research aspects of this broad multidisciplinary program are discussed including: emissions characterization, measurement method development, monitoring, fuels analysis, toxicology, biology, epidemiology, human studies, and unregulated emissions control options. Principal focus is upon catalyst-generated sulfuric acid and noble metal particulate emissions. GRA

N77-24661# Environmental Protection Agency, Washington, D. C. Office of Resources Management.
LEGISLATION, PROGRAMS AND ORGANIZATION
Jan. 1977 65 p
(PB-262873/3) Avail: NTIS HC A04/MF A01 CSCL 13B

This document has been prepared to acquaint the public with the Environmental Protection Agency and its programs. It is organized to describe the legislation authorizing EPA activities, the history and present organization of EPA, and the pollution control programs operated by the Agency and the EPA budget. GRA

N77-24662# Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.
A FRAMEWORK FOR ASSESSING ENVIRONMENTAL IMPACTS OF POSSIBLE ANTARCTIC MINERAL DEVELOPMENT. PART 2: APPENDIX Final Report
David H. Elliot Jan. 1977 445 p
(Contract DOS-1753-600100)
(PB-262751/1; IPS-M-119-Pt-2-App) Avail: NTIS
HC A19/MF A01 CSCL 08I

Content: Antarctic geology and mineral resources; Antarctic marine geology and geophysics; Glaciology and hydrology; Antarctic terrestrial ecosystems; Soils and permafrost; Meteorologica considerations; Southern Ocean physical oceanography; Marine biology; Antarctic biological environment, marine mammals; Avian population. GRA

N77-24663# California Univ., Berkeley. Lawrence Berkeley Lab.
INVESTIGATION OF THE USE OF THE RESONANCE RAMAN EFFECT AS AN ENVIRONMENTAL MONITOR Final Report
Owen Chamberlain, Peter Robrish, and Hal Rosen Oct. 1976 65 p refs
(Grant NSF AG-413)
(PB-262336/1; LBL-5288; NSF/RA-760383) Avail: NTIS
HC A04/MF A01 CSCL 07D

The resonance Raman effect was investigated to determine its usefulness in a Raman Lidar system. Remote detection of pollutant gases, experimental work in molecular spectroscopy, and a description of various research activities were reviewed. GRA

N77-24664# Radian Corp., Austin, Tex.
FEASIBILITY OF PRODUCING ELEMENTAL SULFUR FROM MAGNESIUM SULFITE Final Report, May 1975 - Aug. 1976
Philip S. Lowell, W. E. Corbett, G. D. Brown, and K. A. Wiede Oct. 1976 218 p refs
(Contract EPA-68-02-1319)
(PB-262857/6; EPA-600/7-76-030) Avail: NTIS
HC A10/MF A01 CSCL 07A

Results are given of a study to extend potential applications of MgO flue gas desulfurization processes by allowing the sulfur to be recovered as elemental sulfur as well as sulfuric acid. The feasibility of combining the exothermic SO2 reduction reaction with the endothermic MgSO3 calcination is considered. Preliminary consideration of the reductants carbon monoxide, hydrogen, methane, and hydrogen sulfide showed that the reaction with SO2 can supply part, or in some cases all, of the heat of decomposition of MgSO3. Considered in detail were: low-temperature catalytic decomposition using a commercially avaiable low-Btu synthetic-gas reductant mixture; and high-temperature noncatalytic decomposition using a medium-Btu reducing gas from an oxygen-blown gasifier. Complete heat and material balances for conceptual process designs for the above

cases were developed to identify problems. Recommendations for work required to continue process development are given. Problems identified include catalyst physical stability, catalyst/MgO separation, dust carry-over, and noncatalytic reduction kinetics. GRA

N77-24665# Monsanto Research Corp., Dayton, Ohio. Dayton Lab.

PCB EMISSIONS FROM STATIONARY SOURCES: A THEORETICAL STUDY Final Report

Herman Knieriem, Jr. Oct. 1976 43 p refs
(Contract EPA-68-02-1320)
(PB-262850/1; MRC-DA-577; EPA-600/7-76-028) Avail: NTIS HC A03/MF A01 CSCL 07A

The theoretical assessment concluded that: (1) PCB (polychlorinated biphenyl) emissions are more likely from higher-chlorine content coal or residual oil combustion than from refined oil or natural gas; (2) PCB isomers with four or more chlorine atoms per molecule are more of an environmental hazard than those with three or less; (3) the probability of forming PCB isomers with four or more atoms of chlorine per molecule during combustion is restricted by the short residence times and low concentrations of chlorine available in many fossil fuels; (4) the amount of PCB emissions, if any, may be related to polynuclear aromatic hydrocarbon emissions; (5) based on the above, inefficient combustion control is more likely to produce PCB emissions than optimum conditions; and (6) the highest priority for field sampling and analysis of PCB from combustion sources should be for small- and medium-sized, hand- and underfeed-stoked coal furnaces. GRA

N77-24666# Industrial Environmental Research Lab., Research Triangle Park, N. C.

EPA FABRIC FILTRATION STUDIES. 3: PERFORMANCE OF FILTER BAGS MADE FROM EXPANDED PTFE LAMINATE Final Report, Oct. 1974 - Oct. 1975

Robert P. Donovan, Bobby E. Daniel, and James H. Turner Dec. 1976 53 p refs
(PB-263132/3; IERL-RTP-233; EPA-600/2-76-168c) Avail: NTIS HC A04/MF A01 CSCL 13K

An evaluation of fabric filters made of an expanded polytetrafluoroethylene (PTFR) film supported on a woven Nomex scrim fabric is given. Filtration efficiency was very high and other performance parameters (drag and effective cake resistance) acceptable. The one fabric bag tested for endurance failed prematurely near the bag cuff; even so, it gave evidence of acceptable bag life. GRA

N77-24667# Applied Urbanetics, Inc., Washington, D.C.

VAPOR RECOVERY ANALYSIS

28 Nov. 1976 158 p refs
(Contract FEA-CO-06-60435)
(PB-262846/9; FEA/H-77/030) Avail: NTIS HC A08/MF A01 CSCL 05C

Vapor recovery system (VRS) regulations affecting the retail service station establishments are developed in two stages: Stage 1 VRS refers to the capture of hydrocarbon vapors displaced from underground tanks at the time of bulk product delivery and Stage 2 VRS refers to the capture of vapors displaced from automobile tanks at the time of refueling. Attention is focused primarily on Stage 2 VRS, but a brief discussion of Stage 1 VRS is given. GRA

N77-24668# Herkimer-Oneida Counties Comprehensive Planning Program, Utica, N. Y.

LAND USE INVENTORY UPDATE AND PROJECTION UTICA-ROME AIR QUALITY MAINTENANCE AREA (AQMA) Final Report

Stephen S. Olney Jan. 1977 52 p
(Contract EPA-68-02-2305)
(PB-262906/1; EPA-902/4-77-001) Avail: NTIS HC A04/MF A01 CSCL 13B

The Utica-Rome AQMA consists of 14 Mohawk Valley towns and cities in Herkimer and Oneida Counties, New York. Land uses in the area were inventoried based upon aerial photo measurements of a sample of kilometer squares. Urban land uses are projected to 1980, 1985, 1990, and 2000. GRA

N77-24669# National Bureau of Standards, Washington, D. C.

A SURVEY OF CALIBRATION TECHNIQUES FOR ATMOSPHERIC OZONE MONITORS Final Report

Jimmie A. Hodgeson Dec. 1976 31 p refs
(PB-263534/0; NBSIR-76-1191) Avail: NTIS HC A03/MF A01 CSCL 14B

Calibration techniques for atmospheric ozone (O3) monitors were studied. These calibration techniques are based on iodometry, ultraviolet photometry (UV) and gas phase titration (GPT). The iodometric procedures include a 1 percent neutral buffered potassium iodide (NBKI) technique, a 2 percent NBKI method, and a 1 percent unbuffered KI technique. The data show excellent agreement between O3 determinations by UV or GPT and demonstrate that absolute measurements of trace O3 concentrations can be made by either technique. On the other hand, the NBKI methods yield O3 measurements 1 to 13 percent higher than absolute values when O3 in dry air is analyzed. In the presence of humid air the NBKI measurements are high by factors ranging from 15 to 30 percent. GRA

N77-24670# Environmental Research and Technology, Inc., Santa Barbara, Calif.

TABULATIONS OF (SPECIES CONCENTRATION/CO CONCENTRATION) RATIOS FROM THE LOS ANGELES REACTIVE POLLUTANT PROGRAM (LARPP) DATA

K. Tran, J. R. Martinez, and A. Eschenroeder Dec. 1976 630 p
(PB-264159/5; ERT-P-1656/4) Avail: NTIS HC A99/MF A01 CSCL 13B

A specially processed set of data from the archives of the Los Angles Reactive Pollutant Program (LARPP) is presented. The data have been tabulated to render it useful to air quality modelers, and analysts. As an aid to modelers each average gas concentration measurement is ratioed to the average concentration of carbon monoxide in the four level profiles. On the scale of an urban region, carbon monoxide concentrations are relatively little affected by chemical reactions. GRA

N77-24671# Research Corp. of New England, Wethersfield, Conn. Environmental Technology Div.

DEVELOPMENT OF PROCEDURES FOR THE MEASUREMENT OF FUGITIVE EMISSIONS Final Report, Jul. 1974 - Jun. 1975

P. W. Kalika, R. E. Kenson, and P. T. Bartlett Dec. 1976 134 p refs
(Contract EPA-68-02-1815)
(PB-263992/0; EPA-600/2-76-284) Avail: NTIS HC A07/MF A01 CSCL 13B

The development included: identification of the sources of fugitive emissions, evaluation of sampling strategies, preparation of field test procedures, field evaluation of one fugitive emissions field test procedure, and issuance of technical manuals for each sampling strategy. Eighteen industries/processes which might have potentially significant fugitive emissions were identified, selected from all the industries/processes studied and based on the potential of their fugitive emissions to be hazardous and to have high fugitive emissions rates. The eighteen industries/processes were grouped by category metallurgical processing, energy/fuels processing, chemical products, rock products, and agricultural operations. GRA

N77-24672# Olson Labs., Inc., Anaheim, Calif.

EFFECT OF AUTOMOTIVE PARTS ON VEHICLE AND ENGINE EMISSIONS. PHASE 1: ORIGINAL EQUIPMENT Final Report

Richard R. Carlson Dec. 1976 260 p refs
(Contract EPA-68-01-1957)
(PB-264057/1; EPA-340/2-76-001) Avail: NTIS HC A12/MF A01 CSCL 13B

The primary objective of this study was to identify engine and emission control system components which are critical in causing excessive emissions of one or more regulated pollutants. The emission criticality of original equipment installed by the engine or vehicle manufacturers was investigated. A computer model was developed to calculate and rank order an index representing the criticality of each component type. Separate rankings were developed for HC, CO, NOx and smoke (heavy duty diesel engines) emissions and for vehicles equipped with

catalysts and those without. The index for each component type was calculated from the product of four factors representing the emission increase resulting from a component failure, the probability of component failure, the probability of component repair, and the sales volume of the component. GRA

N77-24673# Clemson Univ., S.C. Water Resources Research Inst.
EFFECTS OF THERMAL POLLUTION ON CERTAIN AQUATIC INVERTEBRATES Final Report
Averett S. Tombes and Byron R. Ingram Aug. 1976 66 p refs
(Contracts DI-14-31-001-3541; DI-14-34-0001-6042)
(PB-263488/9; WRRI-65; W77-04144; OWRT-A-027-SC(2)) Avail: NTIS HC A04/MF A01 CSCL 13B

Ecological and ultrastructural data are presented on selected macroinvertebrates from Lake Keowee which receives heated effluent from three nuclear reactors. The ecological data show the effects of depth, station, location and season on density, diversity and taxonomic composition of the collected benthos. Abundance and diversity of invertebrates were lower at the discharge canal and its surrounding areas than in the intake canal and control areas. Composition of the substrate and temperature of the environment have decided influences on the fauna of this relatively young lake. The subtle biological effects of a temperature change were determined by examining ultrastructurally the nerve cells of the frontal ganglion in Chaoborus punctipennis. GRA

N77-24674# Institute of Gas Technology, Chicago, Ill.
SURVEY OF EMISSIONS CONTROL AND COMBUSTION EQUIPMENT DATA IN INDUSTRIAL PROCESS HEATING Final Report, Jun. 1974 - Nov. 1975
Peter A. Ketels, John D. Nesbitt, and R. Don Oberle Oct. 1976 134 p refs
(Contract EPA-68-02-1821)
(PB-263453/3; EPA-600/7-76-022) Avail: NTIS HC A07/MF A01 CSCL 13B

The interactions between present and potential energy conservation measures and emission programs in various industries were investigated. Where energy conservation goals conflicted with emission control goals, the problems were assessed. Based on these assessments, research and development programs were recommended to solve each industry's problems. The study was limited both to processes in which heat was obtained through the direct combustion of fossil fuels, and to emissions that are affected by combustion itself. GRA

N77-24675# Environmental Protection Agency, Cincinnati, Ohio.
SELF-MONITORING PROCEDURES: BASIC PARAMETERS FOR MUNICIPAL EFFLUENTS: STAFF GUIDE
Charles R. Feldmann Nov. 1976 280 p
(PB-263579/5; EPA-430/1-74-011) Avail: NTIS HC A13/MF A01 CSCL 13B

This course is designed for the treatment plant operator or technician who is required to monitor effluent discharges under a National Pollutant Discharge Elimination System (NPDES) Permit, and who had little or no previous experience in wastewater analysis or flow measurement. Parameters included in this course are BOD, pH, fecal coliform, residual chlorine, suspended solids, and open channel flow. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N77-24676 British Library Lending Div., Boston Spa (England).
PROBLEMS AND THE OUTLOOK IN RESEARCH ON SOLAR-ATMOSPHERIC LINKS
V. F. Loginov [1975] 8 p Transl. into English from Uses. Nauch.-Issled. Inst. Gidromet. Inf.-Mirov. Tsent. Danny. T. Vyp. (Moscow), v. 23, 1975 p 3-5 In ENGLISH and RUSSIAN
(BLL-M-24850-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The development of the problem of the link between the sun and the lower terrestrial atmosphere is proposed. This development is bound up with solving the following problems: (1) accumulation of experimental material on the link and its correct statistical processing, (2) study of the basic causes determining the nature of solar-atmosphere links, namely the sectoral structure and inclination of the interplanetary magnetic field, the efficiency with which active areas on the sun influence the earth, the internal features of atmospheric process, and the distribution of magnetic anomalies, and (3) the experimental verification of the proposed mechanisms by which cosmic agents affect the lower atmosphere. S.M.

N77-24677 British Library Lending Div., Boston Spa (England).
MEASURING APPARATUS FOR SOUNDING THE ATMOSPHERIC BOUNDARY LAYER WITH A TETHERED BALLOON
V. D. Andreyev [1975] 18 p refs Transl. into ENGLISH from Sov. Nat. Kom. Proved. Pigap, Tropex 72 (USSR), 1974 p 654-662 In ENGLISH and RUSSIAN
(BLL-M-24855-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A tethered balloon, allowing for vertical adjustments of the instrument, was used to investigate the atmospheric boundary layer. The balloon complex consisted of a block of sensors, radiotelemetric equipment, receivers and recorders, and a tethered balloon with a windlass. The choice of measurement regimes, the number of working levels, the magnitude of the step in height, and the duration of observation on a given level were some of the tasks. It was shown that it is possible to use a tethered balloon to sound both the water-adjacent and sub-cloud layers. S.M.

N77-24678 British Library Lending Div., Boston Spa (England).
RESEARCH ON A METHOD FOR THE LABORATORY SIMULATION OF ATMOSPHERIC-TYPE WAVES CAUSED BY OBSTACLES IN A STRATIFIED MEDIUM
S. Zh. Nurumov [1975] 22 p Transl. into ENGLISH from Akad. Nauk. SSSR, Inst. Fiz. Atmos. (Moscow), 1975
(BLL-M-24857-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Possible ways of overcoming the difficulties by adopting laboratory modelling methods to research obstacle waves are considered. Author

N77-24679 British Library Lending Div., Boston Spa (England).
THE MECHANISM OF THE EFFECT OF SOLAR ACTIVITY ON THE CIRCULATION OF THE LOWER ATMOSPHERE
A. D. Sytinskiy [1976] 8 p refs Transl. into ENGLISH from Doklady Akad. Nauk. (Moscow), v. 226, 1976 p 570-573
(BLL-M-24871-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Satellite and rocket observations were used to establish a direct relationship between solar activity and expansion of the atmosphere. It was proven that the atmosphere expands under the influence of the solar energy absorption, which in turn decreases the angular velocity and the kinetic potential of the atmosphere. Since the angular velocity is determined mainly by the temperature gradient between the equator and the poles, atmospheric turbulence is created which leads to cyclogenesis. I.M.

N77-24680 British Library Lending Div., Boston Spa (England).
SOVIET GEOLOGY, 1976
V. A. Vakhrameyev [1976] 42 p refs Transl. into ENGLISH from the book "Sovetskaya Geologiya" USSR, Nedra Press, repr. 4, 1976 p 12-25
(BLL-M-24820-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The geological history of the Jurassic period shows that the most abrupt change in physiogeographical, and particularly in climatic, conditions occured not at its lower or upper limit but at the boundary between the middle and late epochs. This is shown especially clearly by a study of the lacustral and continental sediments which form such a significant feature of the northern hemisphere, where the overall continental area is greater than in the southern. Moreover, the distribution of heat-loving marine

organisms at the boundary between Middle and Late Jurassic is also marked by essential changes, indicating great climatic changes at that time. Author

N77-24681 British Library Lending Div., Boston Spa (England).
ON THE USE OF THE OPTO-ACOUSTIC EFFECT FOR AEROSOL ABSORPTION STUDIES
B. M. Golubitakiy and M. V. Tantashev [1976] 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Fiz-Atmos. Okean (Moscow), v. 12, 1976 p 442-443 In ENGLISH and RUSSIAN
(BLL-M-24888-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A theoretical foundation is proposed for a direct method of measuring the coefficient of absorption of an atmospheric aerosol, based on applying the opto-acoustic effect. The distribution of large particles was analyzed by size. This follows from the close relationship between the radius of the particle and its cooling time. The dampness of the absorbing particles was studied by the choice of regime for the irradiating pulse guaranteeing evaporation of the liquid phase. S.M.

N77-24682 British Library Lending Div., Boston Spa (England).
THE NATURE OF THE INFLUENCE OF SOLAR ACTIVITY ON TERRESTRIAL ATMOSPHERE
V. F. Loginov [1976] 28 p refs Transl. into ENGLISH from Vses. Nauch-Issled. Inst. Gidromet. Inf.-Mirov. Tsent. Danny. (Moscow), issue 23, 1975 p 6-29
(BLL-M-24890-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The link between ionospheric parameters and the indices of solar and geomagnetic activity is discussed. Several conclusions were considered: (1) it depends on season, region, time of day, and the duration of disturbances in the sun and in the cosmos, which vary the relationship between electromagnetic and corpuscular radiation, and on the phase of the 11 year cycle in solar activity; (2) the link between upper atmosphere parameters and solar activity is nonlinear; and (3) the contribution of solar and geomagnetic activity to disturbing the parameters of the upper atmosphere depends on the level of the activity concerned, and decreases with loss of height. Author

N77-24683* Illinois Univ., Urbana. Aeronomy Lab.
MIDLATITUDE SPORADIC-E LAYERS
K. L. Miller and L. G. Smith 1 Dec. 1976 257 p refs
(Grants NGR-14-005-181; NSF ATM-75-15523; NSF GA-27295)
(NASA-CR-153057; Rept-76; IULU-ENG-76-2507; ISSN-0568-0581) Avail: NTIS HC A12/MF A01 CSCL 04A

The partially transparent echo from midlatitude sporadic E layers was recorded by ionosondes between the blanketing frequency and the maximum frequency. The theory that the midlatitude sporadic E layers are not uniform in the horizontal plane but contain localized regions of high electron density was evaluated using data obtained by incoherent scatter radar and found to provide a satisfactory explanation. The main features of midlatitude sporadic E layers are consistent with the convergence of metallic ions as described by the wind shear theory applied to gravity waves and tides. The interference of gravity waves with other gravity waves and tides can be recognized in the altitudes of occurrence and the structure of the layers. Small scale horizontal irregularities are attributed in some cases to critical level effects and in others to fluid instabilities. The convergence of a meteor trail can, under some circumstances, account for localized enhancement of the electron density in the layer. Author

N77-24684*# Transemantics, Inc., Washington, D.C.
GENERALIZATION OF THE METHOD FOR AVERAGING THE DISTRIBUTION FUNCTION FOR PARTICLE TRAJECTORIES AS APPLIED TO PROBLEMS OF NUMERICAL MODELING OF CONIC INSTABILITY OF MAGNETOSPHERIC PLASMA
R. S. Churayev, B. I. Kolosov, and D. K. Tkhabisimov Washington NASA Jun. 1977 28 p refs Transl. into ENGLISH of Russian report Pr-297, from Academy of Sciences, Inst. of Space Research (Moscow), 1976 p 1-24
(Contract NASw-2792)
(NASA-TT-F-17538) Avail: NTIS HC A03/MF A01 CSCL 03B

A description of several numerical approaches to a solution of modeling conic instability of magnetospheric plasma on a computer is presented. The possibility of using an averaging algorithm for particle trajectories is established on the basis of results of a solution of the problem concerning particle movement in a magnetic field of the square well type. This permits formulation of an effective method for solving this problem as applied to actual geomagnetic fields. Author

N77-24685*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDY OF A CLOSE-GRID GEODYNAMIC MEASUREMENT SYSTEM
May 1977 197 p refs
(Grant NGR-09-015-002)
(NASA-CR-153201) Avail: NTIS HC A09/MF A01 CSCL 08F

The Clogeos (Close-Grid Geodynamic Measurement System) concept, a complete range or range-rate measurement terminal installed in a satellite in a near-polar orbit with a network of relatively simple transponders or retro-reflectors on the ground at intervals of 0.1 to 10 km was reviewed. The distortion of the grid was measured in three dimensions to accuracies of + or - 1 cm with important applications to geodynamics, glaciology, and geodesy. User requirements are considered, and a typical grid, designed for earthquake prediction, was laid out along the San Andreas, Hayward, and Calaveras faults in southern California. The sensitivity of both range and range-rate measurements to small grid motions was determined by a simplified model. Variables in the model are satellite altitude and elevation angle plus grid displacements in latitude, and height. Author

N77-24686*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL FIELD MEASUREMENTS AT THE FINNEY COUNTY, KANSAS, TEST SITE, OCTOBER 1976: GROUND-BASED MICROWAVE RADIOMETRIC MEASUREMENTS
E. G. Njoku and N. I. Yamane 1 Apr. 1977 29 p ref
(Contract NAS7-100)
(NASA-CR-153205; JPL-Publ-77-13) Avail: NTIS HC A03/MF A01 CSCL 08N

Microwave brightness temperature measurements were made as part of the Joint Soil Moisture Experiment. These measurements are reported with a description of the JPL microwave radiometry van facility. The data will be used with ground truth data from the test site and microwave data from aircraft overflights to investigate the potential of microwave radiometry for soil moisture remote sensing under field conditions. Author

N77-24687*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETOSHEATH ELECTROSTATIC TURBULENCE
Paul Rodriquez (Maryland Univ.) Feb. 1977 55 p refs Submitted for publication
(NASA-TM-X-71314; X-695-77-30) Avail: NTIS HC A04/MF A01 CSCL 04A

The spectrum of electrostatic plasma waves in the terrestrial magnetosheath was studied using the plasma wave experiment on the IMP-6 satellite. Electrostatic plasma wave turbulence is almost continuously present throughout the magnetosheath with broadband (20 Hz- 70 kHz) r.m.s. field intensities typically 0.01 - 1.0 millivolts/m. Peak intensities of about 1.0 millivolts/m near the electron plasma frequency (30 - 60 kHz) were detected occasionally. The components usually identified in the spectrum of magnetosheath electrostatic turbulence include a high frequency ($>$ or $=$ 30 kHz) component peaking at the electron plasma frequency f sub pe, a low frequency component with a broad intensity maximum below the nominal ion plasma frequency f sub pi (approximately f sub pe/43), and a less well defined intermediate component in the range f sub pi $<$ f $<$ f sub pe. The intensity distribution of magnetosheath electrostatic turbulence clearly shows that the low frequency component is associated with the bow shock, suggesting that the ion heating begun at the shock continues into the downstream magnetosheath. Author

N77-24688# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

SHOCK WAVES AND THE ORIGIN OF LIFE
Akiva Bar-Nun (Tel-Aviv Univ., Israel) Jan. 1977 32 p refs (Grant AF-AFOSR-2274-72)
(UTIAS-Rev-41; CN-ISSN-0082-5247) Avail: NTIS HC A03/MF A01

The current views on the origin of life on earth are discussed briefly, with special emphasis on the chemical evolution of the earth's primitive atmosphere which was the opening step towards the origin of life. The various forms of shock-waves in the atmosphere: thunder, meteorite shocks and explosive volcanic eruptions are shown to have been of major importance in the atmospheric evolution, because of their very high efficiency in changing the atmospheric composition and in the formation of the building blocks of life. Author

N77-24689*# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
OBSERVED AND THEORETICAL VARIATIONS OF ATMOSPHERIC OZONE Final Report, 1 Jan. - 30 Apr. 1976
Julius London 30 Apr. 1976 39 p refs
(Grant NsG-2126)
(NASA-CR-153209) Avail: NTIS HC A03/MF A01 CSCL 04A

Observations of backscattered radiation from an Orbiting Geophysical Observatory (OGO) Satellite have been used to determine the global distribution of ozone in different layers in the middle and upper stratosphere. The derived distributions show significant seasonal and geographic variations with important differences indicated between winter and summer hemisphere distributions. The OGO derived distributions are compared with other observations (rocket and satellite) and with photochemical calculations. It is suggested that the increased ozone mixing ratio in the high latitude winter hemisphere can be accounted for by transport processes up to about 40-45 km and by the effects of seasonal variations of NOx, HOx and temperature in the region above. Author

N77-24690*# IBM Federal Systems Div., Gaithersburg, Md.
INVESTIGATION OF THE EFFECT OF ATMOSPHERIC DUST ON THE DETERMINATION OF TOTAL OZONE FROM THE EARTH'S ULTRAVIOLET REFLECTIVITY MEASUREMENTS, 1
J. V. Dave 23 Sep. 1976 134 p refs
(Contract NAS5-23556)
(NASA-CR-152516; TR-1) Avail: NTIS HC A07/MF A01 CSCL 04A

Two computer algorithms are described. These algorithms were used for computing the aximuth-independent component of the intensity of the monochromatic radiation emerging at the top of a pseudo-spherical atmosphere with arbitrary vertical distribution of ozone, and with any arbitrary height distribution of up to two different kinds of aerosol. This atmospheric model was assumed to rest on a surface obeying Lambert's law of reflection. Author

N77-24691*# IBM Federal Systems Div., Gaithersburg, Md.
INVESTIGATION OF THE EFFECT OF ATMOSPHERIC DUST ON THE DETERMINATION OF TOTAL OZONE FROM THE EARTH'S ULTRAVIOLET REFLECTIVITY MEASUREMENTS, 2
J. V. Dave 16 Dec. 1976 132 p refs
(Contract NAS5-23556)
(NASA-CR-152517; TR-2) Avail: NTIS HC A07/MF A01 CSCL 04A

Results of a detailed analysis of the simulated measurements for the BUV (Nimbus-4) configuration are described by using a total-ozone estimation procedure. A set of recommendations are discussed for increasing the accuracy and confidence level of the total ozone values estimated from the measurements of the earth's ultraviolet reflectivity at five different wavelengths (BUV configuration). A tentative procedure is also considered for the estimation of total ozone from measurements of reflectivity at six different wavelengths specified in the SBUV/TOMS (Nimbus-G) configuration. Author

N77-24692*# IBM Federal Systems Div., Gaithersburg, Md.
INVESTIGATION OF THE EFFECT OF ATMOSPHERIC DUST ON THE DETERMINATION OF TOTAL OZONE FROM THE EARTH'S ULTRAVIOLET REFLECTIVITY MEASUREMENTS Final Report
J. V. Dave 12 May 1977 114 p refs
(Contract NAS5-23556)
(NASA-CR-152518) Avail: NTIS HC A06/MF A01 CSCL 04A

Results are presented on the effect of atmospheric aerosols on the value of total ozone, in an atmospheric column of the terrestrial atmosphere, estimated from the simulated measurements of the ultraviolet radiation back scattered by the earth atmosphere models. Simulated measurements were used in five (configuration of the BUV experiment of Nimbus-4 satellite), and in six (configuration of the TOMS section of the SBUV/TOMS experiment on Nimbus-G) narrow spectral regions in the ultraviolet part of the spectrum. Author

N77-24693# Edgerton, Germeshausen and Grier, Inc., Los Alamos, N.Mex.
FINE STRUCTURE OF STRIATIONS OBSERVED IN BARIUM PLASMA INJECTIONS IN THE MAGNETOSPHERIC CLEFT
D. J. Simons, T. E. Eastman, and M. B. Rongratz (Los Alamos Scientific Lab.) 1976 10 p
(Contract E(29-1)-1183)
(EGG-1183-5067) Avail: NTIS HC A02/MF A01

These field-aligned structures appear to form in sheets of approximately constant magnetic latitude. Significant spatial variations occur on a scale of less than 200 meters. Spatial frequency power spectra across the striations have been determined at various times. Observations of the debris cloud and the fast barium streak show strong field-aligned coherency of striation fine structure, indicating a field line mapping of transverse electric fields and gradients. ERA

N77-24694# Kiruna Geophysical Observatory (Sweden).
STUDIES OF AURORAL INFRASONIC SUBSTORMS
Hans Westin Oct. 1976 48 p refs Sponsored in part by Swed. Natural Sci. Res. Council
(Grant NSF GA-41918)
(KGI-76-3) Avail: NTIS HC A03/MF A01

During polar magnetic substorms, 300 auroral infrasonic waves (AIW) were detected in Kiruna during an observing period of 21 months. These AIW have a mean period of 41 s and a mean amplitude of 4.1 microbar. The average horizontal trace velocity is 516 m/s with 78% of the AIW velocities between 350 m/s and 650 m/s, which corresponds to elevation angles between 25 deg and 60 deg. The AIW consist of a dispersed wave packet with a duration of just a few cycles. Their characteristics indicate that they are produced by supersonic electrojets which are coupled to the neutral atmosphere by the Lorentz force and Joule heating. The auroral sources have been identified on all sky camera pictures and on latitude diagrams of perturbations of the vertical component of the geomagnetic field. The AIW are associated with supersonic electrojets moving southward, eastward, or westward, but AIW have never been observed in connection with the poleward motion of an electrojet. Author (ESA)

N77-24695# Academy of Sciences (USSR), Moscow. Space Research Inst.
THE ROLE OF PLASMA PROCESSES IN THE DYNAMICS OF MAGNETOSPHERIC SUBSTORMS
A. A. Galeev and L. M. Zeleny 1976 45 p refs Presented at the Intern. Symp. on Solar Terrest. Phys., Boulder, Colo., 7-18 Jun. 1976
(D-231) Avail: NTIS HC A03/MF A01

The possibilities of energy storage in the magnetospheric tail are associated with the existence of metastable states in plasma configurations with neutral sheets. The spontaneous merging mechanism (the trigger mechanism) responsible for the sharp transition from the energy storage phase to the energy dissipation phase is the development of ion tearing instability. The qualitative scheme of substorm events, including the dayside merging concept, is briefly considered. The possible mechanisms of the plasma sheet replenishment by the charged particles associated with anomalous diffusion of the solar wind plasma across the walls of the polar cusps are discussed. Author (ESA)

N77-24696# Academy of Sciences (USSR), Moscow. Space Research Inst.

RESULTS OF COMPLEX GROUND-BASED AND ROCKET EXPERIMENTS AT DETERMINATION OF ELECTRON COLLISION FREQUENCY AND ELECTRON DENSITY PROFILES AT HEIGHTS 80+500 km OBTAINED FROM GEOPHYSICAL ROCKETS OF VERTICAL SERIES ACCORDING TO INTERCOSMOS PROGRAM

A. V. Birjukov, N. P. Danilkin, R. F. Denisenko, G. M. Kucherenko, I. A. Knorin, V. A. Rudakov, V. V. Sotsky, S. M. Sustchy, J. N. Faer, and L. A. Shnyreva 1976 25 p refs Presented at the 19th COSPAR meeting, Philadelphia, Jun. 1976

(D-246) Avail: NTIS HC A02/MF A01

Complex measurements of the electron density and collision frequency were carried out at solar zenith angles 69 deg and 67 deg in July and September, 1975, at middle latitudes of the European part of the USSR. The density was measured by the dispersion interferometer method based on a rocket of the vertical series (including Vertical-3 according to the Intercosmos program). Simultaneously vertical sound and polarization measurements of the radiowave absorption at ten frequencies were also performed. The profiles of the electron collision frequency were determined as a result of the joint processing of the ground-based and rocket data. Comparison of results of measurements with theoretical profiles is presented. Author (ESA)

N77-24697# Academy of Sciences (USSR), Moscow. Space Research Inst.

CONVECTION IN THE MAGNETOSPHERE (LABORATORY EXPERIMENT DATA)

E. M. Dubinin, I. M. Podgorny and Y. N. Potanin 1976 27 p refs

(PR-285) Avail: NTIS HC A03/MF A01

The pattern of convection in the artificial magnetosphere was developed from the measurements of electric and magnetic fields and plasma flows. The convection was observed inside the region of closed field lines; its explanation does not involve any reconnection mechanism. The results confirm the assumption made about the radiation belt filling by the plasma convection from the nightside. A convection scheme for polar caps is not dealt with. Author (ESA)

N77-24698# Ludwig-Maximilians-Universitat, Munich (West Germany). Inst. fuer Meteorologie.

STATISTICAL PROPERTIES OF ENERGY DISSIPATION Ph.D. Thesis [STATISTISCHE EIGENSCHAFTEN DER ENERGIEDISSIPATION]

Carl Freytag May 1976 131 p refs In GERMAN

(Mitt-27) Avail: NTIS HC A07/MF A01

Experiments were carried out to investigate the energy budget and turbulence of the atmospheric boundary layer. The resulting data was used to examine the statistical properties of the energy dissipation. Hypotheses formulated by Kolmogorov and Obukhov concerning the dissipation were tested. A test method was established for the experimental investigation of the dissipation, allowing measurement of instantaneous values thereof. Results confirm the hypotheses and models based on cascade processes. ESA

N77-24699# Stockholm Univ. (Sweden). Dept. of Meteorology.

ON THE GENERATION OF GRAVITY WAVES IN A TWO-LAYER LINEARIZED MODEL USING DIFFERENT INITIALIZATION METHODS

Stefan Gollvik and Lennart Thaning 2 Dec. 1976 33 p refs

(Contracts G-223-58; G-223-70)

(DM-22) Avail: NTIS HC A03/MF A01

Results show that initialization using the divergence from the quasigeostrophic model gives less gravity motion than the geostrophic wind initialization, except for short waves in a strongly baroclinic atmosphere. The divergence obtained by an iterative process also gives this result. Author (ESA)

N77-24700# Flow Research, Inc., Kent, Wash.

A NUMERICAL AND EXPERIMENTAL STUDY OF STABLY STRATIFIED FLOW AROUND COMPLEX TERRAIN Final Report, May 1974 - Mar. 1975

J. J. Riley, H. T. Liu, and E. W. Geller May 1976 43 p refs 2 Vol.

(Contract EPA-68-02-1293)

(PB-262540/8; Flow-Res-58; EPA-600/4-76-021) Avail: NTIS HC A03/MF A01 CSCL 13B

A computer program was developed to compute three-dimensional stratified flow around complex terrain for the case of very strong stratification (small internal Froude number). Laboratory experiments were performed for strongly stratified flow past three different terrain models for comparison. The computed results are in fair agreement with the experiments for the cases of two simpler terrain models. The discrepancies are probably attributable to the separated wake in the lee of the models. The agreement was not as good for the case of the more complex terrain. Possible sources of error are discussed in some detail. GRA

N77-24701# Flow Research, Inc., Kent, Wash.

PLUME DISPERSION IN STABLY STRATIFIED FLOWS OVER COMPLEX TERRAIN, PHASE 2 Final Report, May 1974 - Mar. 1975

H. T. Liu and J. T. Lin May 1976 68 p refs

(Contract EPA-68-02-1293)

(PB-262541/6; Flow-Res-57; EPA-600/4-76-022) Avail: NTIS HC A04/MF A01 CSCL 13B

Laboratory experiments were conducted in a stratified towing tank to investigate plume dispersion in stably stratified flows. First, plume dispersion over an idealized terrain model with a simulated elevated inversion in the atmosphere was investigated. These results were compared with those of experiments previously conducted under simulated ground inversions. Second, plume dispersion in 1-layer stably stratified flows over a realistic terrain was also modeled. The plume dispersion patterns showed a strong interaction between the stratified flow and the rugged terrain features. Third, plume dispersion during inversion breakup was simulated. Results indicated that as soon as the convective layer built to reach the plume, pollutants were stirred and carried to the ground. GRA

N77-24702# Alaska Univ., College. Geophysical Inst.

REPORT ON THE GEOPHYSICAL DESCRIPTION AND AVAILABLE DATA ASSOCIATED WITH ROCKET PF-NH-89 (IC 507.11-2A)

Gerald J. Romick Hanscom AFB, Mass. AFCRL Jan. 1976 40 p

(Contract F19628-74-C-0188; DNA Proj. NWET-L25AAXYX966)

(AD-A034731; APCRL-TR-76-0010; DNA-HAES-54; SR-6) Avail: NTIS HC A03/MF A01 CSCL 04/1

A Nike-Hydac rocket was launched at 09:12:20 UT on March 10, 1975 from Poker Flat Research Rocket Range. This rocket reached an apogee altitude of 152 km with a total flight time greater than 454 seconds. The payload was successfully recovered. The rocket was launched during an intense auroral substorm (-600 gamma in delta H) into a westward traveling surge. The sky at Ester Dome and Ft. Yukon was clear. No meridian scanning photometer data were recorded at either Ft. Yukon or Ester Dome due to camera malfunction. However, analysis of the ground ASC data recorded at Ester Dome and Ft. Yukon can be used to assist in determining the relationship of the on-board data to the aurora. GRA

N77-24703# Texas Instruments, Inc., Dallas. Equipment Group.

VELA NETWORK EVALUATION AND AUTOMATIC PROCESSING RESEARCH Quarterly Report, 10 Jul. - 10 Oct. 1976

Lawrence S. Turnbull, Jr. 10 Oct. 1976 8 p

(Contract F08606-76-C-0011; ARPA Order 2551)

(AD-A034769; TI-ALEX(01)QR-76-05; QR-5) Avail: NTIS HC A02/MF A01 CSCL 17/10

Work in the following areas is summarized: array and network evaluation; signal detection methods; signal estimation techniques; and discrimination. GRA

N77-24704# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.

RELATION BETWEEN BOUNCE-AVERAGED COLLISIONAL TRANSPORT COEFFICIENTS FOR GEOMAGNETICALLY TRAPPED ELECTRONS Interim Report

Michael Schulz 8 Dec. 1976 16 p refs
(Contract F04701-76-C-0077)
(AD-A034120; SAMSO-TR-76-104; TR-0077(2260-20)-15) Avail: NTIS HC A02/MF A01 CSCL 20/8

The unweighted bounce average (N(j)) of the atmospheric (Nj) along a field line and the weighted bounce average ((B(0)/B)N(j) cos squared alpha) are related (for each atmospheric constituent (j)) by an integral or derivative with respect to the sine (y) of the equatorial pitch angle (alpha(0)), where B/B(0)(1/y squared sin squared alpha) is the ratio of local to equatorial magnetic-field intensity and alpha is the local pitch angle. The unweighted bounce average (N(j)) is relevant to energy deposition by radiation-belt particles of all species, while the weighted bounce average ((B(0)/B)N(j) cos squared alpha) is relevant to the description of pitch-angle diffusion of radiation-belt electrons. Author (GRA)

N77-24705# Picatinny Arsenal, Dover, N. J.
GROUND SHOCK EFFECTS FROM ACCIDENTAL EXPLOSIONS Final Report, Mar. 1975 - Jun. 1976
Robert J. Odello (Naval Civil Eng. Lab.) and Paul Price Nov. 1976 44 p refs
(AD-A033208; PA-TR-4995) Avail: NTIS HC A03/MF A01 CSCL 19/4

This report describes a study of the effects of ground shock from accidental explosions on structures and their contents. Semi-empirical equations for estimating peak air-blast induced and direct-induced ground shock motions are presented. The design implications of ground shock effects are discussed. The general conclusion is that ground shock effects are more critical to the vulnerability of persons or equipment within structures than for the vulnerability of structures per se. Recommended design procedures and suggestions for further study are presented. GRA

N77-24706# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EVALUATION OF MASS INTEGRAL SCALING AS APPLIED TO THE ATMOSPHERIC RADIATION TRANSPORT PROBLEM Ph.D. Thesis
Raymond A. Shulstad Nov. 1976 201 p refs
(AD-A032940; DS/PH/76-3) Avail: NTIS HC A10/MF A01 CSCL 18/3

This report presents the results of a comprehensive evaluation of mass integral scaling (MIS) as applied to the atmospheric radiation transport problem. MIS is an approximation used to predict the free-field radiation environments from atmospheric nuclear detonations. Codes like SMAUG and ATR use mass integral scaling of infinite homogeneous air transport data to generate environments which purport to reflect the near exponential vertical variation in density of air. The results are presented in the form of a series of mass range curves for a particular source spectrum and source/receiver altitude. These curves may be used to extract multiplicative MIS correction factors. A series of MIS isoerror contours, which clearly define the error bounds over various spatial domains, is also presented. GRA

N77-24707# Alaska Univ., College. Geophysical Inst.
REPORT ON THE GEOPHYSICAL DESCRIPTION AND AVAILABLE DATA ASSOCIATED WITH ROCKET PF-SH-92 (IC 519.07-1B)
Gerald J. Romick Hanscom AFB, Mass. AFGL Jan. 1976 47 p ref
(Contract F19628-74-C-0188; DNA Proj. NWET-L25AAXYX966)
(AD-A034381; AFGL-TR-76-0007; DNA-HAES-55; SR-7) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report covers technical activities performed during the period November 1975 through January 1976. It provides a geophysical description of the auroral and geomagnetic environment during the launch of ICECAP rocket PF-SH-92 (IC 519.07-18). An interpretation of the primary measurements obtained by the sensors onboard this specific experimental payload is included. GRA

N77-24708# Sydney Univ. (Australia). Civil Engineering Labs.
APPLICATION OF THE INITIAL STRESS METHOD TO SOIL STRUCTURE INTERACTION
R. K. Rowe, J. R. Booker, and N. P. Balaam Oct. 1976 36 p refs
(PB-262324/7; R-294) Avail: NTIS HC A03/MF A01 CSCL 13B

The soil and structure are treated as separate bodies related only by nodal forces at the soil-structure interface. Provision is made for plastic failure of both soil and structure, shear failure at the interface, and breakaway of the structure from the soil. The significance of these features is illustrated by considering a number of examples. GRA

N77-24709# Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.
A FRAMEWORK FOR ASSESSING ENVIRONMENTAL IMPACTS OF POSSIBLE ANTARCTIC MINERAL DEVELOPMENT, PART 1 Final Report
David H. Elliot Jan. 1977 175 p refs
(Contract DOS-1753-600100)
(PB-262750/3; IPS-M-119-Pt-1) Avail: NTIS HC A08/MF A01 CSCL 08I

The physical environment of Antarctica is described. Hypothetical resources were considered to develop an environmental assessment. Unavoidable impacts on the on-shore and off-shore environments resulting from exploration and exploitation are identified and discussed. Alternatives and special provisions are discussed and recommendations presented. GRA

N77-24710# Lamont-Doherty Geological Observatory, Palisades, N. Y.
STUDY OF EARTHQUAKE HAZARDS IN NEW YORK AND ADJACENT STATES Annual Technical Report, 1 Jul. 1975 - 30 Jun. 1976
Marc Sbar, Yash Aggarwal, and Lynn Sykes 12 Jan. 1977 104 p refs Sponsored in part by Nuclear Regulatory Commission
(PB-262248/8; NYSERDA-75/20) Avail: NTIS HC A06/MF A01 CSCL 08K

Over the last five years, Lamont-Doherty has installed a network of 30 short period seismic stations in New York State and adjacent parts of New Jersey and Vermont to study the seismicity, stress, earthquake source properties, and crustal structure in this area. The data indicate that seismic activity in New York is concentrated in the northern, western, and southeastern parts of the state; the central part appears to be relatively aseismic. GRA

N77-24711# Harza Engineering Co., Chicago, Ill.
COMPREHENSIVE GROUND CONTROL STUDY OF A MECHANIZED LONGWALL OPERATION. VOLUME 2: SPECIAL REPORTS. 1: PHYSICAL PROPERTIES OF COAL AND COAL MEASURE ROCKS. 2: BEARING CAPACITY OF ROOF AND FLOOR ROCKS. 3: RESPONSE OF BOREHOLE PRESSURE CELLS. 4: INSTALLATION OF SUBSURFACE INSTRUMENTATION Final Report
30 Jan. 1976 270 p
(Contract DI-BM-H0230012)
(PB-262476/5; BM-OFR-5-77-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 08I

Strata control measurements on an operating longwall are described from which engineering design values for structural parameters such as convergence in the face area and support load density, as function of the rate of mining and the strata properties can be extracted. Volume 11 contains four special reports: physical properties of coal and coal measure rocks, bearing capacity of roof and floor rocks, response of borehole pressure cells, and installation of subsurface instrumentation. GRA

N77-24712# Geological Survey, Menlo Park, Calif. Water Resources Div.
A GUIDE FOR APPLICATION OF THE COMPUTER PROGRAM FOR THE MODIFIED EINSTEIN METHOD OF COMPUTING TOTAL SEDIMENT DISCHARGE (MODEIN)
D. E. Burkham, C. G. Kroll, and George Porterfield Jan. 1977 143 p refs
(PB-262429/4; USGS-WRD-WRI-77-004) Avail: NTIS HC A07/MF A01 CSCL 08A

A computer technique is described. The Modein computer

program computes total sediment discharge according to the current usage of the modified Einstein procedure. Data required for the program are limited to that required for normal hand computation. GRA

N77-24713# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
REFRACTIVE INDEX VARIANCE AND ITS HEIGHT DISTRIBUTION IN DIFFERENT AIR MASSES
Earl E. Gossard Jun. 1976 39 p refs
(PB-263404/6; NOAA-TR-ERL-369; WPL-46; NOAA-76120602) Avail: NTIS HC A03/MF A01 CSCL 04A

The general refractive properties of air masses and their associated frontal discontinuities are discussed, and the refractive index distribution with height is calculated. Based on certain assumptions, the distribution of refractive index structure constants is then deduced and the results are compared with the limited observational data available. The deducted height distributions of refractive index structure function are compared with the very limited amount of observational data that exist. GRA

N77-24714# Systems Control, Inc., Palo Alto, Calif.
THE ANALYSIS OF SUBSIDENCE ASSOCIATED WITH GEOTHERMAL DEVELOPMENT. VOLUME 1: HANDBOOK
R. W. Atherton, E. J. Finnemore, and M. L. Gilliam Sep. 1976 287 p refs 3 Vol.
(Grant NSF AER-75-17298)
(PB-263692/6; NSF/RA-760414-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 08I

The state of knowledge of subsidence associated with geothermal development is evaluated and preliminary methods to assess the potential of land subsidence for any specific geothermal site are provided. The results are presented in three volumes. Volume 1 is designed to serve as a concise reference, a handbook, for the evaluation of the potential for land subsidence from the development of geothermal resources. GRA

N77-24715# Systems Control, Inc., Palo Alto, Calif.
THE ANALYSIS OF SUBSIDENCE ASSOCIATED WITH GEOTHERMAL DEVELOPMENT. VOLUME 2: RESEARCH REPORT
R. W. Atherton, E. J. Finnemore, and M. L. Gilliam Sep. 1976 668 p refs 3 Vol.
(Grant NSF AER-75-17298)
(PB-263693/4; NSF/RA-760415-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 08I

A compendium of research results on subsidence and geothermal energy is provided as well as backup information to the subsidence handbook. Topics treated included; (1) the fundamentals of geothermics; (2) the geology and physical processes of subsidence; (3) a survey of subsidence and reservoir models; (4) and methods for evaluating subsidence potential via analogy or analysis methods. GRA

N77-24716# Systems Control, Inc., Palo Alto, Calif.
THE ANALYSIS OF SUBSIDENCE ASSOCIATED WITH GEOTHERMAL DEVELOPMENT. VOLUME 3: INFORMATION BANK
M. L. Gilliam, B. E. Kenks, and R. W. Atherton Sep. 1976 185 p refs 3 Vol.
(Grant NSF AER-75-17298)
(PB-263694/2; NSF/RA-760416-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 08I

The following are included: (1) a glossary of specialized terms as they are used in geothermal subsidence and directly related topic areas; (2) a listing of institutions and organizations possessing specialized collections of documents related to geothermal subsidence; (3) a keyword index of the documents obtained; and (4) an alphabetical listing of more than 1000 documents collected and catalogued during the study. GRA

N77-24717# United Technologies Research Center, East Hartford, Conn.
CALCULATION OF ENERGETICS OF SELECTED ATMOSPHERIC SYSTEMS Final Report, 1 Oct. 1973 - 30 Apr. 1976
H. Harvey Michels Hanscom AFB, Mass. AFGL 30 May 1976 79 p refs
(Contract F19628-73-C-0300)
(AD-A034462) Avail: NTIS HC A05/MF A01 CSCL 04/1

Present theoretical efforts which are directed toward a more complete and realistic analysis of the transport equations governing atmospheric relaxation and the propagation of artificial disturbances require detailed information of thermal opacities and LWIR absorption in regions of temperature and pressure where molecular effects are important. Although various experimental techniques have been employed for both atomic and molecular systems, theoretical studies have been largely confined to an analysis of the properties (bound-bound, bound-free and free-free) of atomic systems. This has been due in large part to the unavailability of reliable wavefunctions for diatomic molecular systems, and particularly for excited states or states of open-shell structures. More recently, reliable theoretical procedures have been prescribed for such systems which have resulted in the development of practical computational programs. Author (GRA)

N77-24718# Epsilon Labs., Bedford, Mass.
SATELLITE DENSITY GAUGE INSTRUMENTATION PROGRAM Final Report, 15 Mar. 1974 - 30 Sep. 1976
Theodore E. Ciesielski and John Dulchinos Hanscom AFB, Mass. AFGL Oct. 1976 18 p
(Contract F19628-74-C-0156; AF Proj. 6690)
(AD-A034428; AFGL-TR-76-0271) Avail: NTIS HC A02/MF A01 CSCL 14/2

The report describes the design and development of two density measuring systems to be included in an Air Force satellite. The sensor is a cold cathode gauge used for the measurement of density at satellite altitudes. A second experiment will serve to provide data relating to the vehicle attitude. Both instruments utilize electrometer amplifiers in the range of 0.0001 A to 10 to the minus 9th power A. Author (GRA)

N77-24719# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
A HIGH-LATITUDE EMPIRICAL MODEL OF SCINTILLATION EXCURSIONS: PHASE 1
Jules Aarons, John Mullen, Herbert Whitney, Eileen Martin, Krishin Bhavnani (Emmanuel College, Boston), and Leo Whelan (Logicon, Inc., Bedford, Mass.) 17 Sep. 1976 57 p refs
(AF Proj. 4643)
(AD-A034420; AFGL-TR-76-0210; AFGL-AFSG-353) Avail: NTIS HC A04/MF A01 CSCL 04/1

Using observations of the scintillations of beacons from synchronous satellites, a high latitude model of scintillation excursion is being developed. Phase 1 of the development has been completed and is described in this report. Several years of continuous recordings taken at Narssarssuaq, Greenland, Goose Bay, Labrador, and Sagamore Hill, Massachusetts, were reduced. The data base consists of values of 15-min scintillation excursions in dB at 137 MHz. Equations are developed which yield scintillations at this frequency as a function of local time, magnetic index, solar flux, and month of the year. The concept is to predict, at sub-auroral and auroral latitudes, scintillation at this frequency and at higher frequencies. The aim is to give to users an indication of expected scintillation excursion when one predicts magnetic activity and solar radio flux. The equations developed have been checked with one additional set of observations and are being checked with additional data. Phase 2 of this model will incorporate geometrical terms to take account of the propagation angle of the observer vis-a-vis the irregularities and will allow for frequency dependence to be ascertained. In addition, it is expected in Phase 2 to validate the model with additional sets of data, extending the model to auroral latitudes greater than 63 deg. and to polar latitudes.
Author (GRA)

N77-24720# California Univ., Berkeley. Earthquake Engineering Research Center.
GADFLEA: A COMPUTER PROGRAM FOR THE ANALYSIS OF PORE PRESSURE GENERATION AND DISSIPATION DURING CYCLIC OR EARTHQUAKE LOADING
J. R. Booker, M. S. Rahman, and H. Bolton Seed Oct. 1976 64 p refs
(Grant NSF ENV-75-21875)
(PB-263947/4; EERC-76-24) Avail: NTIS HC A04/MF A01 CSCL 08M

A method of analysis of the equations governing pore pressure generation and dissipation based on the finite element method is developed and illustrated by application to a variety of problems. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-24721 British Library Lending Div., Boston Spa (England).
THE EFFECT OF MESOSCALE NON-UNIFORMITIES OF THE UNDERLYING SURFACE ON THE WIND PROFILE IN THE ATMOSPHERIC BOUNDARY LAYER
N. A. Lazareva, L. R. Orlenko, and O. B. Shklyarevich [1975] 13 p refs Transl. into ENGLISH from Glav. Geof. Obs., T. Vyp. (Leningrad), v. 326, 1975 p 102-108 In ENGLISH and RUSSIAN
(BLL-M-24854-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The effect of non-uniformities in the underlying surface on the profile of the meteorological elements are estimated. The height to which the effect extends as a function of the nature and dimensions of the non-uniformity is determined. The characteristics of the distribution of wind and temperature in urban conditions are considered. Author

N77-24722 British Library Lending Div., Boston Spa (England).
EXPERIENCE IN CARRYING OUT A COMPLETE RADIATION EXPERIMENT
K. Ya. Kondratyev [1976] 5 p refs Transl. into ENGLISH from Ukr. Nauch-Issled. Gidromet. Inst., Radiat. Process Atmos. Earth's Surf. (Kiev), 1974 p 35-37
(BLL-M-24875-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The corpus of simultaneous meteorological aerosol and other measurements assembled in the course of the CRE (complete radiation experiment) provided the possibility of making a detailed calculation of the fluxes of short and longwave radiation for subsequent comparison with experimental values. In addition to checking the actual accuracy of schemes of numerical computation on the basis of comparing calculation with observation we also obtained estimates of the contribution of aerosol to the absorption of shortwave radiation. Absorption in the 300- 8,000 m layer was found to be 0.03 cal/square cm min. For the entire atmospheric layer from the surface to 8,000 m it amounted to 0.08 cal/square cm min. Author

N77-24723 British Library Lending Div., Boston Spa (England).
THE PRACTICAL APPLICATION TO WEATHER FORECASTING OF DATA ON SOLAR ACTIVITY
B. M. Rubashev [1976] 19 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 355, 1975 p 3-16
(BLL-M-24886-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Literature concerning the effect of solar activity on meteorological phenomena is discussed. The fact was presented that researchers investigating the appearance of solar activity in the troposphere are separated from the practical forecasting service, while there is a well known predominance of operational staff in the field of meteorology concerning possible external effects on meteorological processes. Author

N77-24724 British Library Lending Div., Boston Spa (England).
CHEMICAL COMPOSITION OF FOG WATER
A. Kirkaite, K. Shopauskas, and V. Gedraitis 20 Dec. 1976 20 p refs Transl. into English from Zashchita Atmosfery ot Zagryaznenii (USSR), v. 1, 1974 p 64-83
(BLL-CE-Trans-7023-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The chemical composition and degree of mineralization of fog water was studied. The condensation nuclei, the presence in the atmosphere of various impurities in the form of aerosols, dust and gases, and also the meteorological conditions governed the chemical nature. Author

N77-24725# National Aviation Facilities Experimental Center, Atlantic City, N. J.
WIND SHEAR: A LITERATURE SEARCH, ANALYSIS, AND ANNOTATED BIBLIOGRAPHY Final Report, Jul. - Oct. 1976
Jack J. Shrager Feb. 1977 93 p refs
(FAA Proj. 154-451-110)
(AD-A037310; FAA-NA-77-5; FAA-RD-76-114) Avail: NTIS HC A05/MF A01 CSCL 04/2

Post 1970 publications on low altitude wind shear and its relationship to aircraft operations during approach, landing, and takeoff were surveyed and analyzed with respect to: (1) wind shear characterization/atmospheric modeling; (2) hazard definition/accident analysis; (3) ground based equipment; (4) airborne equipment; (5) flight test and simulation; (6) forecasting/meteorology; and (7) flight operations/pilot training. The analysis of 216 documents identified by the literature search are summarized. Author

N77-24726*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
AN ATLAS OF 1975 GEOS-3 RADAR ALTIMETER DATA FOR HURRICANE/TROPICAL DISTURBANCE STUDIES, VOLUME 1
H. Ray Stanley, Barbara Chan (EG and G, Pocomoke City, Md.), and John R. Munson (EG and G, Pocomoke City, Md.) Apr. 1977 245 p
(Contract NAS6-2639)
(NASA-TM-X-69364-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 04B

Geographic locations of 1975 hurricanes and other tropical disturbances were correlated with the closest approaching orbits of the GEOS-3 satellite and its radar altimeter. The disturbance locations and altimeter data were gathered for a seven-month period beginning with GEOS-3 launch in mid-April 1975. Areas of coverage were the Atlantic Ocean, the Carribean, the Gulf of Mexico, the west coast of the continental United States, and the central and western Pacific Ocean. Volume 1 contains disturbance coverage data for the Atlantic Ocean, Gulf of Mexico, and Eastern Pacific Ocean. Central and Western Pacific coverage is documented in Volume II. Author

N77-24727*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
AN ATLAS OF 1975 GEOS-3 RADAR ALTIMETER DATA FOR HURRICANE/TROPICAL DISTURBANCE STUDIES, VOLUME 2
H. Ray Stanley, Barbara Chan (Wolfe Research and Development Corp., Pocomoke City, Md.), and John R. Munson (Wolfe Research and Development Corp., Pocomoke City, Md.) Apr. 1977 241 p
(Contract NAS6-2639)
(NASA-TM-X-69364-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 04B

For abstract, see N77-24726.

N77-24728*# Texas A&M Univ., College Station. Center for Applied Geosciences.
A STUDY OF THE UNIFICATION OF GROUND AND INFLIGHT WIND CRITERIA FOR THE SPACE SHUTTLE Final Report
James R. Scoggins and Gregory S. Wilson Washington NASA May 1977 54 p refs
(Contract NAS8-29764)
(NASA-CR-2845; M-220) Avail: NTIS HC A04/MF A01 CSCL 04B

Wind data measured on a 444-m tower located near Oklahoma City, Oklahoma, were used to investigate the structure of wind and turbulence in the height interval from 150 m to 1 km. The structure of wind and turbulence in the layer not encompassed by the existing design criteria was researched and ways for unifying the ground and inflight criteria were investigated. Steady state vertical wind profiles, directional wind component envelopes, wind shear, wind direction change, gust factor, and turbulence spectra are encompassed. A method is proposed for the specification of steady state wind profiles and shear envelopes for use in the region between 150 m and 1 km without altering in any way the existing design criteria. The data analyzed

did not indicate a need for changing the existing criteria in regards to wind direction change, gust factor, or spectra of turbulence. Author

N77-24729# Brookhaven National Lab., Upton, N.Y.
FUTURE OIL SUPPLY TO THE NORTHEAST UNITED STATES
H. Bronheim Jun. 1976 87 p refs
(Contract E(30-1)-16)
(BNL-50557) Avail: NTIS HC A05/MF A01

Under various assumptions of total U.S. reserves of oil (discovered and undiscovered) coupled to alternate schedules of national resource development, projections of crude oil production were made for the years 1985 and 2000. The projections indicate that even under optimistic conditions crude oil production will be declining in the post-1985 period, if not earlier. The scenarios consistently indicate that the Northeast's regional share will be heavily constrained by 1985, and rapidly declining thereafter. ERA

N77-24730# Bochum Observatory (West Germany). Inst. fuer Weltraumforschung.
DIRECT RECEPTION OF METEOROLOGICAL SATELLITE DATA BY MEANS OF STATIONS ON SHIPS. DETERMINATION OF THE SURFACE TEMPERATURE OF THE WATER ON THE LINE FROM IS-FJORD/SPITZBERGEN - BAERENINSEL - NORTH CAPE./NORWAY. EXPLORING EXPEDITION ON MS-EUROPE FROM 31 JULY - 21 AUGUST 1976 BREMERHAVEN-SPITZBERGEN-BREMERHAVEN
Heinz Kaminski 1976 86 p refs In GERMAN; ENGLISH summary
Avail: NTIS HC A05/MF A01

A satellite reception unit with automatic picture data output was developed and installed onboard the MS Europe during an Arctic cruise. A fixed antenna was used for reception of NOAA 4 and 5 scanning radiometers for data in the 137 MHz range. Received data were combined with radio weather forecasts to update the meteorological forecasts for ship control. The scanning radiometer data allowed exact course determination for reaching the pack-ice border beyond Spitzbergen. Results on reception quality are reported. ESA

N77-24731# Technology Service Corp., Santa Monica, Calif.
EMPIRICAL TECHNIQUES FOR ANALYZING AIR QUALITY AND METEOROLOGICAL DATA. PART 1: THE ROLE OF EMPIRICAL METHODS IN AIR QUALITY AND METEOROLOGICAL ANALYSES Final Report, May 1974 - Dec. 1975
W. S. Meisel Jul. 1976 73 p refs
(Contract EPA-68-02-1704)
(PB-261446/9; TSC-PD-132-2-Pt-1; EPA-600/4-76-029a)
Avail: NTIS HC A04/MF A01; also available in set of 3 reports, PB-261445-SET, HC E06 CSCL 13B

The types of problems, for which creative empirical approaches have the potential for significant contributions are illustrated. The results of two pilot projects are reported in some detail. GRA

N77-24732# Technology Service Corp., Santa Monica, Calif.
EMPIRICAL TECHNIQUES FOR ANALYZING AIR QUALITY AND METEOROLOGICAL DATA. PART 2: FEASIBILITY STUDY OF A SOURCE-ORIENTED EMPIRICAL AIR QUALITY SIMULATION MODEL
W. S. Meisel and M. D. Teener Jun. 1976 68 p refs
(Contract EPA-68-02-1704)
(PB-261447/7; TSC-PD-132-3-Pt-2; EPA-600/4-76-029b)
Avail: NTIS HC A04/MF A01; also available in set of 3 reports, PB-261445-SET, HC E06 CSCL 13B

Meteorological dispersion functions in multiple-source simulation models for urban air quality are specified on the basis of data from special field experiments. In the urban environment, individual sources cannot be isolated. One may, however, ask for a source-receptor relationship which, when summed (or integrated) over all the sources, would minimize the average squared error in prediction of measured values. The feasibility of this approach is demonstrated by application to model-generated data, where the source-receptor relationship is known. GRA

N77-24733# Air Force Geophysics Lab., Hanscom AFB, Mass.
A MODEL FOR ESTIMATING JOINT PROBABILITIES OF WEATHER EVENTS
Iver A. Lund and Donald D. Grantham 7 Dec. 1976 8 p refs Presented at 7th Conf. on Aerospace and Aeron. Meteorology and Symp. on Remote Sensing from Satellites, Melbourne, Fla., 16-19 Nov. 1976
(AD-A034081; AFGL-TR-76-0288) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological satellites have made it possible to obtain information on areal coverage and joint occurrences of meteorological events not heretofore possible. However, a long record of observations is required to derive a climatology of joint occurrences. Routine, hourly, surface weather observations may be sufficiently concurrent to estimate joint occurrences among sites where such observations are taken. This paper describes a model to 13 years of hourly winter and summer United States between La Guardia Airport, N. Y., and Raleigh Durham Airport, N. C. It requires a knowledge of the unconditional probability of the event, distances between the sites, and a measure of the spatial correlation. Probabilities estimated by the model agree very well with relative frequencies of observed joint occurrences of precipitation. Satellite observations are needed to derive the parameters of the model and to test it in areas where surface observations are unavailable or unsuitable. Author (GRA)

N77-24734# Weather Wing (3rd), Offutt AFB, Nebr.
MAJOR SNOWSTORM DEVELOPMENT OVER THE MIDWEST UNITED STATES
Eugene M. Weber 15 Dec. 1976 94 p refs
(AD-A034656; Rept-3WW-TN-76-2) Avail: NTIS HC A05/MF A01 CSCL 04/2

This technical note discusses the various atmospheric conditions essential to the development of major wintertime storm systems over the Midwest (Central United States). Primary emphasis is placed upon determination of areas favorable for cyclogenesis. Intensification and movement of the 500mb low as a function of 500mb height falls tendency is presented. Identification, intensification, and movement of the main surface system is then introduced. Finally, the related developments at all levels of the atmosphere, as they occurred during the January 1975 Blizzard, are shown. Author (GRA)

N77-24735# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ARTILLERY METEOROLOGICAL ANALYSIS OF PROJECT PASS Research and Development Technical Report, Nov. - Dec. 1974
Abel J. Blanco and Larry E. Traylor Ft. Monmouth, N. J. Oct. 1976 42 p refs
(AD-A032678; ECOM-5804) Avail: NTIS HC A03/MF A01 CSCL 19/5

The Atmospheric Sciences Laboratory, U.S. Army Electronics Command, conducted a comprehensive experiment in ballistic meteorology during November-December 1974 at White Sands Missile Range. The purpose was to determine what improvement might be made in the representativeness of meteorological messages furnished to artillery batteries by collecting all meteorological data available in a corps size area, performing a relatively simple analysis, and disseminating the results to the batteries. One thousand rounds of 8-inch howitzer ammunition were fired over a 5-week period with concurrent meteorological data taken at eight sites on the Missile Range. The most striking feature of the results is the relatively small deviation in predicted impact (less than 40 m range sigma) due to meteorological error in 85% of the 79 firing series analyzed. Author (GRA)

N77-24736# Meteorology International, Inc., Monterey, Calif.
DEVELOPMENT OF THE CAPABILITY FOR SURFACE-WIND ANALYSIS ON A PORTABLE GRID FIB/UV-PORT Final Report
Bruce R. Mendenhall Jan. 1976 79 p refs
(Contract N00228-75-C-2379)
(AD-A034291; NEPRF-TR-4-76(MII)) Avail: NTIS HC A05/MF A01 CSCL 04/2

The basic analysis capability is the Fields-by-Information Blending (FIB) methodology. The FIB technique has been used successfully in many atmospheric and oceanic applications to

date. The surface wind analysis capability, FIB/UV, has been designed to use a concurrent sea-level-pressure analysis via a diagnostic balance relationship for first-guess information for both the winds and the spreading of the winds. The sea-level-pressure analysis capability FIB/P has been designed to provide this first-guess information for FIB/UV in that both analyses are done on a staggered grid where the grid locations for u, v and p have been chosen for optimum use of the diagnostic relationship. GRA

N77-24737# Air Force Geophysics Lab., Hanscom AFB, Mass.
OBSERVED MEAN MONTHLY WINDS AT STANDARD PRESSURE SURFACES FROM 850 mb TO 100 mb Final Environmental Research Papers
Arthur J. Kantor 30 Sep. 1976 44 p refs
(AF Proj. 8624)
(AD-A034378; AFGL-TR-76-0234; AFGL-ERP-578) Avail: NTIS HC A03/MF A01 CSCL 04/2

This paper contains tables of mean monthly east-west and north-south wind components for January, April, July, and October at 200 Northern Hemisphere locations. GRA

N77-24738# Air Force Geophysics Lab., Hanscom AFB, Mass.
MULTI-PREDICTOR CONDITIONAL PROBABILITIES
Irving I. Gringorten 6 Oct. 1976 26 p refs
(AF Proj. 9624)
(AD-A034379; AFGL-TR-76-0239; AFGL-AFSG-354) Avail: NTIS HC A03/MF A01 CSCL 04/2

A predictand's probability distribution is modified by information on one or more of its predictors. If linear dependence is assumed between the predictand and the predictors transformed into normal Gaussian variates, then a model algorithm is possible for the conditional probability of the predictand. It is given as the probability that a Gaussian variable (eta) will equal or exceed a threshold value (eta sub c) where (eta sub c) is expressed linearly in terms of specific normalized values of the predictors. The predictor coefficients, known as partial regression coefficients, are functions of the correlations between predictors and the correlations between each predictor and the predictand. This stochastic model was tested on regular 3-hourly observations of precipitation-produced radar echoes at five widely scattered stations in the eastern half of the United States. The results revealed strong evidence of the validity of the probability estimates, but more importantly revealed that the model can yield sharp estimates of the conditional probability with as many as seven predictors. GRA

N77-24739# Air Force Geophysics Lab., Hanscom AFB, Mass.
LIGHTNING AND SQUALL LINE IDENTIFICATION FROM DMSP SATELLITE PHOTOGRAPHS
Antoine H. Sizoo and James A. Whalen 28 Oct. 1976 16 p refs
(AF Proj. 7663)
(AD-A034380; AFGL-TR-76-0256; AFGL-AFSG-355) Avail: NTIS HC A02/MF A01 CSCL 04/2

Unusual light streaks appearing in high resolution nighttime satellite photographs of the United States were investigated to determine their origin. The temporal and spatial variations of the light streaks and their association with clouds suggested that the satellite sensor detected lightning. In this preliminary study, a satellite photograph recorded during new moon was compared with synoptic weather maps and surface weather observations from selected stations. GRA

N77-24740# Scripps Institution of Oceanography, La Jolla, Calif.
OBSERVATIONS OF THERMAL STRUCTURE IN THE CENTRAL PACIFIC
T. P. Barnett, M. H. Sessions, and P. M. Marshall Nov. 1976 50 p refs
(Contract N00014-75-C-0152)
(AD-A034357; SIO-Ref-76-19) Avail: NTIS HC A03/MF A01 CSCL 04/2

The ultimate goal of this field program, called AIRPAC, in conjunction with other programs in NORPAX, is to describe and quantitatively explain the observed temporal and spatial fluctuations of the near-surface thermal field. A knowledge of why the subsurface temperature patterns change and their relation to sea surface temperature anomalies, could have a direct bearing on climate forecasts. Author (GRA)

N77-24741# National Climatic Center, Asheville, N. C.
STORAGE-GAGE PRECIPITATION DATA FOR WESTERN UNITED STATES 1975, VOLUME 20
1976 37 p
(PB-263424/4; NOAA-76122002) Avail: NTIS HC A03/MF A01 CSCL 04B

Storage-gage precipitation data are reported for the Western United States and includes data for the period 1974-1975. Data on precipitation measurements, station changes, a station index for each state, and maps identifying the location of data collection sites in the states are included. GRA

N77-24742# National Center for Atmospheric Research, Boulder, Colo.
PROCEEDINGS OF THE SYMPOSIUM ON METEOROLOGICAL OBSERVATIONS FROM SPACE: THEIR CONTRIBUTION TO THE FIRST GARP GLOBAL EXPERIMENT
J. I. Kelly and S. Ruttenberg Sep. 1976 437 p Conf. held at Philadelphia, 8-10 Jun. 1976
(Contract NSF C-760)
(PB-262530/9; NCAR-5101-76-1) Avail: NTIS HC A19/MF A01 CSCL 04B

Six sessions treated the following major topics: temperature and humidity fields derived from satellite observations, surface characteristics of importance to weather and climate, wind determination from geostationary satellites, role of the earth's radiation budget in atmospheric dynamics, data collection systems and some programmatic developments, and application of satellite data to numerical analysis and prediction. GRA

N77-24743# Sperry Rand Corp., Great Neck, N. Y. Systems Management Div.
HIGHWAY FOG: VISIBILITY MEASURES AND GUIDANCE SYSTEMS Final Report
William H. Heiss Nov. 1976 52 p refs Sponsored in part by the Am. Assoc. of State Highway and Transportation Officials
(PB-764246/0; TRB/NCHRP/REP-171; ISBN-0-309-02512-5; LC-76-45299) Avail: NTIS HC A04/MF A01 CSCL 13B

Highway fog problems were analyzed and a fog visibility index was developed to quantify fog levels as a measure of detrimental effects on driver performance and traffic operations. The fog visibility index, which predicts the distance at which a vehicle stopped in fog can be seen, uses instrument visibility and ambient light level as inputs. A survey of fog measuring instruments showed that scatter types appear to be the most suitable for general highway use, although all are subject to errors in patchy fog banks with single-instrument installations. GRA

N77-24744# National Climatic Center, Asheville, N. C.
USE OF CLIMATIC DATA IN ESTIMATING STORAGE DAYS FOR SOILS TREATMENT SYSTEMS Final Report, Apr. 1975 - Jul. 1976
Dick M. Whiting Nov. 1976 98 p refs Sponsored by EPA
(PB-263597/7; EPA-600/2-76-250) Avail: NTIS HC A05/MF A01 CSCL 04B

Computer programs have been developed to estimate storage needs for Soil Treatment Systems from analyses of daily climatological data. One program uses a set of thresholds for temperature, precipitation and/or snow depth to estimate storage needs in colder regions. A second program is designed for use in high rainfall regions where saturated soil, rather than severe weather, is the limiting condition. GRA

N77-24745# Environmental Sciences Research Lab., Research Triangle Park, N.C.
DIURNAL VARIATIONS IN CARBON MONOXIDE CONCENTRATIONS, TRAFFIC COUNTS AND METEOROLOGY Technical Report, Sep. 1975 - Feb. 1976
Gerard A. Demarrais Feb. 1977 37 p refs
(PB-263898/9; EPA-600/4-77-009) Avail: NTIS HC A03/MF A01 CSCL 04B

Hourly data from a large network of carbon monoxide monitoring stations, with instrumentation corrected for moisture interference, are analyzed and compared with traffic flow and

meteorological conditions at several locations in Maryland. The meteorological phenomena that appear to be important in explaining the diurnal variations involve the ventilation effects resulting from variable wind speeds and mixing heights. GRA

N77-24746# National Weather Service, Silver Spring, Md. Office of Hydrology.
PRECIPITABLE WATER OVER THE UNITED STATES. VOLUME 1: MONTHLY MEANS
George A. Lott Nov. 1976 181 p refs Sponsored in part by the Army Corps of Engineers and the Soil Conservation Service
(PB-264219/7; NOAA-TR-NWS-20; NOAA-77011110) Avail: NTIS HC A09/MF A01 CSCL 04B

A climatological summary of precipitable water over the contiguous states, Alaska, and adjacent water is presented. These data are presented in tables accompanied by a computer-created seasonal plot of two layers, surface-to-500 mb, and surface-to-150 mb above the surface. Maps also show geographical distribution, suggest probable moisture sources, and show comparisons between stations. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-24747*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORIGIN OF THE EARTH'S OCEAN BASINS
Herbert Frey Apr. 1977 37 p refs Submitted for publication
(NASA-TM-X-71318; X-922-77-84) Avail: NTIS HC A03/MF A01 CSCL 08J

The earth's original ocean basins were mare-type basins produced 4 billion years ago by the flux of asteroid-sized objects responsible for the lunar mare basins. Scaling upwards from the observed number of lunar basins for the greater capture cross-section and impact velocity of the Earth indicates that at least 50 percent of an original global crust would have been converted to basin topography. These basins were flooded by basaltic liquids in times short compared to the isostatic adjustment time for the basin. The modern crustal dichotomy (60 percent oceanic, 40 percent continental crust) was established early in the history of the earth, making possible the later onset of plate tectonic processes. These later processes have subsequently reworked, in several cycles, principally the oceanic parts of the earth's crust, changing the configuration of the continents in the process. Ocean basins (and oceans themselves) may be rare occurrences on planets in other star systems. Author

N77-24748# World Meteorological Organization, Geneva (Switzerland).
HANDBOOK ON WAVE ANALYSIS AND FORECASTING
1976 91 p refs
(WMO-446; ISBN-92-63-10446-8) Avail: NTIS HC A05/MF A01; WMO, Geneva Sw. Fr 37

The basic concepts used in wave theory, and their applications, are described. Operational methods used in wave analysis and forecasting are outlined, including the measurement and observation of waves, wind field analysis, and a description of wave analysis and forecasting both by manual and computer methods. Wave-accretion graphs are given, and the type of calculation used in the forecasting of swell is also explained. ESA

N77-24749# Naval Surface Weapons Center, White Oak, Md.
REAL TIME THREE LAYER OCEAN MODEL Final Report
Philip J. Craun 5 Apr. 1976 283 p
(AD-A033678; NSWC/WOL/TR-75-115) Avail: NTIS HC A13/MF A01 CSCL 09/2

The simulation of acoustic targets in the ocean environment requires an ocean model which produces realistic propagation effects. This report describes a three layer ocean model which is part of a real time acoustic signal generator developed at this laboratory. The ocean model is written in Data General assembly language and runs on a Super Nova minicomputer. Detailed charts and listings of the ocean model are included. GRA

N77-24750# Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
SHORELINE EROSION AND LANDSLIDES IN THE GREAT LAKES
Tuncer B. Edil and Luis E. Vallejo Oct. 1976 19 p refs Sponsored by NOAA
(PB-263394/9; NOAA-76122903; Rept-15) Avail: NTIS HC A02/MF A01 CSCL 08G

Stability of coastal bluffs is examined in order to determine the mechanics of bluff recession and the long-term trends in the evolution of coastal slopes. Six active bluffs in two locations on the western shore of Lake Michigan are monitored for erosion-sliding processes in an integrated program of field and laboratory investigation and stability analysis. Landslides constitute only one part of the overall bluff toe and the degradation of the bluff face by solifluction and surface runoff. Two different models of slope evolution are established for the bluffs monitored. GRA

N77-24751# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Lab.
STD OBSERVATIONS FROM THE R/V COLUMBUS ISELIN DURING PHASE 3 OF GATE
William McLeish and S. Michael Minton Aug. 1976 108 p refs
(PB-263395/6; NOAA-TR-ERL-379; AOML-24; NOAA-76120601) Avail: NTIS HC A06/MF A01 CSCL 08J

A computer processing scheme was modified for these particular data. Plots of temperature, salinity, and sigma-T versus pressure and temperature salinity diagrams were prepared. The processed values at 1-decibar intervals were written on magnetic tape and placed in the archives of the National Oceanographic Data Center. GRA

N77-24752# Geological Survey, Menlo Park, Calif.
MODAL DATA AND NOTES ON MINERAL ASSEMBLAGES FOR METAMORPHIC ROCKS OF THE SANTA LUCIA RANGE, CALIFORNIA COAST RANGES
Donald C. Ross Feb. 1976 38 p refs
(PB-262505/1; USGS-GD-77-001) Avail: NTIS HC A03/MF A01 CSCL 08G

Medium- to high-grade metamorphic rocks underlie more than 900 sq km of the northern Santa Lucia Range. They appear to have been derived almost exclusively from a sedimentary terrane. Widely distributed plagioclase amphibolite may in part reflect mafic igneous rocks, but the amphibolite is commonly interbedded in the gneissic terrane and closely associated with marble, which suggests a sedimentary source. These modes and mineral assemblage data suggest a vast and relatively similarly metamorphosed terrane for most of the range; at least locally there are higher grade hot spots in the western part of the range. GRA

N77-24753# Massachusetts Inst. of Tech., Cambridge. Sea Grant Program.
BRINGING THE OCEANS INTO AMERICA'S FUTURE. A REPORT ON THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY SEA GRANT PROGRAM Annual Report, 1 Jul. 1975 - 30 Jun. 1976
S. Bronwyn Hurd and Ralph Coburn Dec. 1976 35 p Sponsored by NOAA
(PB-264262/7; MITSG-77-2; NOAA-77012509; INDEX-77-002-Zay) Avail: NTIS HC A03/MF A01 CSCL 08J

Summaries of various activities completed or underway on: advising industry of the oceans potential; new technologies; management of coastal environments; treatment of oil spills; and living resources, are presented. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-24754 British Library Lending Div., Boston Spa (England).
THE EFFECT OF COLONIZATION BY ANIMAL AND PLANT ORGANISMS ON ASPHALT STRUCTURES IN SEA WATER
Claus D. Mueller 20 Dec. 1976 18 p refs Transl. into ENGLISH from Bitumen (West Ger.), no. 5, 1966 p 142-147 (BLL-CE-Trans-6946-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The effect of marine organisms on asphalt was examined. Consideration was given to those structures which, in the tidal zone, are either covered or washed each day by water. Experiments were performed with asphalts of various compositions. The effect animals and plants forming colonies on asphalt in sea water have on the substrate was studied. Only the occurrence of mechanical changes and effects which can be detected with the naked eye were examined. The effect the level in the tidal zone has on the possibility of the creatures or plants forming the colonies was previewed. Author

N77-24755*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
WATER SYSTEM VIRUS DETECTION Patent Application
A. S. Fraser (Organon Diagnostics, El Monte, Calif.), A. F. Wells (Organon Diagnostics, El Monte, Calif.), and H. J. Tenoso, inventors (to NASA) (Organon Diagnostics, El Monte, Calif.) Filed 28 Apr. 1977 19 p
(Contract NAS9-14102)
(NASA-Case-MSC-16098-1; US-Patent-Appl-SN-792068) Avail: NTIS HC A02/MF A01 CSCL 06A

A waste-water reclamation system is monitored by introducing a non-pathogenic marker virus, bacteriophage F2, into the waste water prior to treatment and, thereafter, testing the reclaimed water for the presence of the marker virus. A test sample is first concentrated by adsorbing any marker virus onto a cellulose acetate filter in the presence of a trivalent cation at low pH and then flushing the filter with a limited quantity of a gylcine buffer solution to desorb any marker virus present on the filter. Photo-optical detection of indirect passive immune agglutination by polystyrene beads indicates the performance of the water reclamation system in removing the marker virus. A closed system provides for concentrating any marker virus, initiating and monitoring the passive immune agglutination reaction, and then flushing the system to prepare for another sample. NASA

N77-24756# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
AN EPR STUDY OF X-RAY IRRADIATED SERUM METALLOPROTEINS
M. Bomba, S. Cannistraro, and P. L. Indovina 3 Jan. 1976 31 p refs In ITALIAN; ENGLISH summary Submitted for publication
(ISS-P-76/1) Avail: NTIS HC A03/MF A01

A review on ceruloplasmin is presented, in particular on the several kinds of copper ions bound to the protein. The results of an EPR study performed on human serum samples, frozen at 77 K and X-ray-irradiated, are reported. The results seem to indicate that the copper in an EPR non-detectable state, the presence of which has been demonstrated, is available under the form of strongly interacting Cu++ pairs. ESA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-24757*# Scientific Translation Service, Santa Barbara, Calif.
PROBLEMS OF SPACE BIOLOGY. VOLUME 33: GRAVITY AND THE BODY
N. P. Dubinin, ed. Washington NASA Apr. 1977 309 p refs Transl. into ENGLISH of the book "Problemy kosmicheskoy biologii. Tom 33: Gravitatsiya i Organizm", Moscow, Nauka Press, 1976 p 1-287
(Contract NASw-2791)
(NASA-TT-F-17526) Avail: NTIS HC A14/MF A01 CSCL 06P

The role of research, development, and demonstration (RD and tics of plants and animals and its significance in the development and realization of hereditary information is discussed. The monograph will be useful both for researchers working in the area of gravitational biology and for biologists and doctors interested in the effect of gravity on vital activity. Author

N77-24758*# Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
RUSSIAN LITERATURE ON AVIATION, SPACE AND HIGH-ALTITUDE BIOLOGY AND MEDICINE: A BIBLIOGRAPHY. VOLUME 2
A. A. Sergeyev Washington NASA Jun. 1977 675 p ref Transl. into ENGLISH from the book "Otechestvennaya literatura po aviatsionnoy, vysokogornoy i kosmicheskoy biologii i meditsina, vyp. 2", Leningrad, Nauka Press, 1974 p 1-177
(Contract NSF C-630)
(NASA-TT-F-16119; TT-75-52043) Avail: NTIS HC A99/MF A01 CSCL 06D

This volume presents 4,415 reference to Russian domestic documents, published in the years 1967 to 1971 inclusively, devoted to specific problems in the fields of aviation, space and high-altitude biology and medicine. There is a subject index consisting of 67 categories. Author

N77-24759# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A MYOCYBERNETIC CONTROL MODEL OF SKELETAL MUSCLE
H. Hatze Aug. 1976 47 p refs
(WISK-220) Avail: NTIS HC A03/MF A01

A mathematical model of skeletal muscle is presented which contains the two physiological control parameters stimulation rate and motor unit recruitment. The modelling procedure relies entirely on established myo-physiological facts and each assumption made is substantiated by experimental data. Extensive simulation studies reveal that the model is capable of correctly predicting practically all known phenomena of the muscular force-output. A simplified version of the model is also presented, particularly suitable for inclusion as the driving structure in complex musculoskeletal link systems. This version was successfully tested in the prediction of an optimal human motion. Author

N77-24760# Berkeley Scientific Translation Service, Calif.
PHENOMENA ASSOCIATED WITH ULTRASONIC PROPAGATION IN BIOLOGICAL SYSTEMS: HARMFUL ULTRASONIC EFFECTS
R. Zana Jul. 1976 24 p refs Transl. into ENGLISH from Biomedicine (France), v. 20, 1974 p 273-280
(Contract W-7405-eng-48)
(UCRL-Trans-11116) Avail: NTIS HC A02/MF A01

Thermal effects, cavitation and acoustic microstreaming are the three main effects associated with the propagation of ultrasound in fluids. After considering the physical origin of these effects, the modifications that they can bring in biological media (biomacromolecular solutions, cell suspensions, tissues) are reviewed. Recent studies of ultrasonic threshold dosages for the induction of adverse effects in cells and tissues are described. They conclude that ultrasound dosages used in medical diagnostics are innocuous. ERA

N77-24761# Oak Ridge National Lab., Tenn.
EFFECTS OF CTR IRRADIATION ON THE MECHANICAL PROPERTIES OF STRUCTURAL MATERIALS
F. W. Wiffen Nov. 1976 39 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5624) Avail: NTIS HC A03/MF A01

Mechanical properties of CTR structural materials are important in determining the reliability and economics of fusion power. Furthermore, these properties are significantly affected by the high neutron flux experienced by components in the regions near the plasma of the fusion reactor. In general, irradiation hardens the material and leads to a reduction in ductility. An exception to this is in some complex engineering alloys where either hardening or softening can be observed depending on the alloy and the irradiation conditions. Regardless of this restriction, irradiation usually leads to a reduction in ductility. Available tensile

data examined show that significant ductility reduction can be found for irradiation conditions typical of CTR operation. Consideration of these effects shows that extensive work will be needed to fully establish the in-service properties of CTR structures. ERA

N77-24762# Battelle Pacific Northwest Labs., Richland, Wash.
POTENTIAL SOURCES FOR THE RADIATION TREATMENT OF FOOD
W. E. Sande and R. A. Libby Aug. 1976 31 p refs
(Contract E(45-1)-1830)
(BNWL-2095) Avail: NTIS HC A03/MF A01

A major consideration in the design of large-scale economical food irradiation systems is the radiation source. The 'traditional' gamma radiation source, Co60, is presently produced by the irradiation of Co59 in nuclear reactors. In addition, other radioisotopes with appropriate characteristics for food irradiation systems are presently available or may be available in the future. These radioisotopes are certain waste fission products formed in nuclear reactor fuel during operation. These materials may be separated after the fuel is discharged from the reactor. For example, Cs137 formed in Hanford reactors is presently being produced in an encapsulated form at the Waste Encapsulation and Storage Facility at Hanford, Washington. The use of Co60 Cs137 and other potential radiation sources is discussed from the standpoint of supply systems, characteristics of the isotopes, encapsulated forms, quantities available, timing of availability, and economics. ERA

N77-24763# Cincinnati Univ., Ohio. Dept. of Engineering Analysis.
NUMERICAL PREDICTION OF HEAD/NECK RESPONSE TO SHOCK-IMPACT
J. C. Huston (Iowa State Univ., Ames), C. E. Passerello, and R. L. Huston 1 Aug. 1976 14 p refs
(Contracts N00014-76-C-0139; PHS-NS-42302)
(AD-A034683) Avail: NTIS HC A02/MF A01 CSCL 06/19

A three-dimensional, 54 deg of freedom computer model of the head/neck system is presented. The model consists of a series of rigid bodies representing the bones and vertebrae together with springs and dampers representing the muscles, discs, ligaments, and joints. Equations of motion are written for the model by using Lagrange's form of d'Alembert's principle. Computer algorithms are developed to numerically calculate the coefficients of these equations. The governing equations are then integrated numerically for a number of specific cases. The results agree very well with experimental data. Author (GRA)

N77-24764# Dayton Univ., Ohio. Research Inst.
EVALUATION OF SAFE EXPOSURE GUIDELINES FOR MODERATE AND HIGH INTENSITY CONTINUOUS NOISE Technical Report, 1 Feb. - 31 Jul. 1976
Thomas R. Schori Nov. 1976 147 p refs
(Contract F33615-75-C-5055; AF Proj. 6231)
(AD-A034605; AMRL-TR-76-97) Avail: NTIS HC A07/MF A01 CSCL 06/19

The TTS2 (temporary threshold shift measured two minutes after noise termination) consequences of brief noise exposures were systematically evaluated. Specifically, forty subjects were tested at each of 10 appropriately spaced noise exposure levels. The 90th percentile TTS2 at 4000 Hz was determined for each exposure level and then a multiple regression equation was fitted to these values. From this equation, a 5 dB equal 90th percentile TTS2 curve was calculated, which represents the author's predictions as to the trade-offs between noise intensity and exposure duration necessary to produce 90th percentile TTS2s of 5 dB. A comparison of the author's predictions to those of the Environmental Protection Agency (EPA) (in the area of uncertainty) suggests that the conservative EPA predictions may be too conservative while the EPA's modified and extended National Research Council Committee on Hearing, Bioacoustics, and Biomechanics (CHABA) criterion predictions may not be sufficiently conservative. Although the author's predictions reflect the trends which were actually observed in the present investigation, it would be unreasonable to assume that the author's predictions are more than 'ball park' estimates of reality. GRA

N77-24765# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
MEASUREMENT OF RF POWER-ABSORPTION IN BIOLOGICAL SPECIMENS (10 TO 100 MHz) Final Report, 1 Jan. - 1 Oct. 1976
Frank M. Greene Nov. 1976 33 p refs
(PB-263101/8; NBS-TN-687) Avail: NTIS HC A03/MF A01 CSCL 06R

The RF power being absorbed by a biological specimen during non-ionizing radiation-exposure testing using the NBS RF Near-Field Synthesizer in the frequency range 10 to 100 MHz was determined. The method is based solely on measuring the forward and reflected power on the transmission line feeding the synthesizer. The method has the advantage that the exact measuring point on the feed line is not critical, as it is with methods employing direct impedance measurements, and that the required measurements are made without interfering with the exposure tests. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors;, individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-24766*# Kanner (Leo) Associates, Redwood City, Calif.
PROBLEMS OF CREATING BIOTECHNICAL SYSTEMS OF HUMAN LIFE SUPPORT
I. I. Gitel'zon, ed. Washington NASA Apr. 1977 347 p refs Transl. into ENGLISH of the book "Problemy Sozdaniya Biologo-tekhnicheskikh Sistem Zhizneobespecheniya Cheloveka" Novosibirsk, Nauka Press, 1975 p 1-272
(Contract NASw-2790)
(NASA-TT-F-17533) Avail: NTIS HC A15/MF A01 CSCL 06K

Various aspects of the cultivation of higher plants as a possible link of a biological life support system, including experiments with various higher plants, their radiation sensitivity, and cultivating equipment, are presented. Various aspects of the cultivation of single celled algae as the regeneration link in a life support system, including studies of photosynthesis, morphology, physiology, nutrition including treated solid human waste and other sources of nutrients, and methods and techniques of continuous cultivation of single celled algae, primarily Chlorella, are presented. The use of nonphotosynthesizing microbe cultures, especially the microflora and microfauna of activated sludge, for biological mineralization of human wastes and Chlorella metabolites are discussed. Author

N77-24767*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
EXPLORATION OF AN OCULOMETER-BASED MODEL OF PILOT WORKLOAD
Marjorie J. Krebs, James W. Wingert, and Thomas Cunningham Mar. 1977 121 p refs
(Contract NAS1-13092)
(NASA-CR-145153; Honeywell-76-SRC/39) Avail: NTIS HC A06/MF A01 CSCL 05E

Potential relationships between eye behavior and pilot workload are discussed. A Honeywell Mark IIA oculometer was used to obtain the eye data in a fixed base transport aircraft simulation facility. The data were analyzed to determine those parameters of eye behavior which were related to changes in

level of task difficulty of the simulated manual approach and landing on instruments. A number of trends and relationships between eye variables and pilot ratings were found. A preliminary equation was written based on the results of a stepwise linear regression. High variability in time spent on various instruments was related to differences in scanning strategy among pilots. A more detailed analysis of individual runs by individual pilóts was performed to investigate the source of this variability more closely. Results indicated a high degree of intra-pilot variability in instrument scanning. No consistent workload related trends were found. Pupil diameter which had demonstrated a strong relationship to task difficulty was extensively re-exmained.
Author

N77-24768*# Martin Marietta Corp., Denver, Colo.
PROTO-FLIGHT MANIPULATOR ARM (P-FMA) Final Report
W. R. Britton Apr. 1977 119 p
(Contract NAS8-31487)
(NASA-CR-150277; MCR-77-201) Avail: NTIS HC A06/MF 01 CSCL 05H

The technical development of the Proto-Flight Manipulator Arm (P-FMA) which is a seven-degree-of-freedom general-purpose arm capable of being remotely operated in an earth orbital environment is discussed. The P-FMA is a unique manipulator, combining the capabilities of significant dexterity, high tip forces, precise motion control, gear backdriveability, high end effector grip forces and torques, and the quality of flightworthiness. The 2.4-meter (8-foot) arm weighs 52.2 kilograms (115 pounds).
Author

N77-24769*# Telephonics, Huntington, N.Y.
EVALUATION OF LIGHTWEIGHT HEADSETS FOR SPACE SHUTTLE APPLICATION Final Technical Report
Oct. 1976 75 p
(Contract NAS9-14824)
(NASA-CR-151265) Avail: NTIS HC A04/MF A01 CSCL 05H

Contemporary lightweight headsets were evaluated for: intelligibility, frequency response, sensitivity, distortion, noise isolation, acoustic quality, weight, and wearer comfort. Author

N77-24770# Royal Aircraft Establishment, Farnborough (England).
FEATURES OF THE SPEECH SIGNAL DURING THE CUMULATIVE ACTIONS OF CORIOLIS ACCELERATIONS
A. V. Nikonov and F. A. Solodounik Nov. 1976 8 p refs Transl. into ENGLISH from Voenno-Med. Zh. (USSR), v. 7, 1972 p 78-81
(RAE-Ub-Trans-1909; BR55708) Avail: NTIS HC A02/MF A01

Possible variations of the acoustic characteristics of a speech signal caused by the cumulative action of Coriolis accelerations and subsequent nausea in the subject were investigated. Results indicate that for short exposures of up to 1 minute of Coriolis' accelerations, the speech intensity is raised by 1 to 2dB and the basic tone frequency increases significantly. However during the onset of nausea, the speech intensity falls below the initial value by 1 to 2dB and the basic tone frequency is reduced.
Author

N77-24771*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELECTRIC DISCHARGE FOR TREATMENT OF TRACE CONTAMINANTS Patent Application
Daniel L. Flamm (Stanford Univ., Calif.) and Theodore J. Wydeven, Jr., inventors (to NASA) Filed 23 May 1977 19 p
(NASA-Case-ARC-10975-1; US-Patent-Appl-SN-799832) Avail: NTIS HC A02/MF A01 CSCL 06K

A radio-frequency glow discharge reactor for removing trace contaminants from an oxygen bearing atmosphere including a reaction chamber defined by an inner metal electrode facing a dielectric backed by an outer conductive electrode was considered. In one embodiment, a conductive liquid forms the conductor of an outer electrode and cools the dielectric. A resonator coupled to a variable radio-frequency source generates the high voltages for creating a glow discharge in the chamber at a predetermined pressure whereby the trace contaminants are oxidized into a few simple non-toxic products that may be easily recovered.
NASA

N77-24772*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NASA FIREFIGHTERS BREATHING SYSTEM PROGRAM REPORT
William B. Wood Washington May 1977 73 p refs
(NASA-TN-D-8497; JSC-S-465) Avail: NTIS HC A04/MF A01 CSCL 05H

Because of the rising incidence of respiratory injury to firefighters, local governments expressed the need for improved breathing apparatus. A review of the NASA firefighters breathing system program, including concept definition, design, development, regulatory agency approval, in-house testing, and program conclusion is presented.
Author

N77-24773# Army Aeromedical Research Lab., Fort Rucker, Ala.
AVIATOR PERFORMANCE DURING DAY AND NIGHT TERRAIN FLIGHT Final Report
Michael A. Lees, Kent A. Kimball, Mark A. Hofmann, and Lewis W. Stone Nov. 1976 33 p refs
(AD-A034898; USAARL-77-3) Avail: NTIS HC A03/MF A01 CSCL 17/7

Terrain flying, both day and night, is now an Army aviation tactical requirement. The present investigation compared terrain flight during Low Level (LL) and Nap-of-the-Earth (NOE) profiles for: (1) day flight with the unaided eye; (2) night flight with the unaided eye; and (3) night flight using night vision goggles. Data were acquired through use of the Helicopter In-Flight Monitoring System(HIMS). The total sets of inflight measures were analyzed separately for both LL and NOE with further analysis on the subsets of pilot control variables and aircraft status variables. Multiple discriminant analysis techniques were used to determine which measures best discriminated between visual conditions. For the LL flight profiles, the results indicate that performance factors describing air speed and the frequency of small control inputs best discriminated between visual conditions. For NOE flight profiles, it was determined that performance factors measuring severity of roll angles, and the frequency and magnitude of control input, best discriminated between the three visual conditions.
Author (GRA)

N77-24774# National Highway Traffic Safety Administration, Washington, D. C. Safety Research Lab.
ANALYSIS OF COMFORT AND CONVENIENCE FACTORS IN IMPROVED RESTRAINT SYSTEMS Final Technical Report, Jul. - Nov. 1976
Stephen Gordon, Akira Kondo, and David Breedon Dec. 1976 65 p refs
(PB-263157/0; DOT-HS-802-113) Avail: NTIS HC A04/MF A01 CSCL 13F

Six occupant restraint systems (both current production and prototype) were evaluated in terms of comfort and convenience by 30 subjects. A paired comparison statistical procedure was developed that considers each subject as an independent control factor and, therefore, eliminated personal bias. The modified Seville was significantly better than the other systems. The modified Volare, standard Volare, and Impala rated in the upper to middle category. The Rabbit and Chevette ranked as the worst systems tested. Smoothness, repeatability, and comfortable tension in the shoulder belt retractor appeared to be the most important factors influencing comfort and convenience.
GRA

N77-24775# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PERFORMANCE OF THE HUMAN PERIPHERAL VISUAL SYSTEM UNDER VARIOUS LOADS M.S. Thesis
Daniel R. Burchfield Dec. 1976 142 p refs
(AD-A034270; GE/EE/76-16) Avail: NTIS HC A07/MF A01 CSCL 05/5

This report measured the effects of single and multiple spatial presentations in various positions in the human peripheral visual field. Subjects fixated on a central point and attempted to accurately discern orientations of peripherally located stimuli. The peripheral tasks were sine-wave gratings generated on HP-120 5A oscilloscopes. Stimuli were presented at various

positions along the horizontal and vertical axes of the visual field. Stimulus presentation times were 20, 50, 100, and 500 msec. Lateral differences in perception were noted with the data showing high statistical significance. The number of events processed also proved to be a significant variable. The dominance of the right cerebral hemisphere for processing spatial information was very evident. Such results have strong implications as to where spatial presentations should be located in the visual field to maximize visual performance. GRA

N77-24776# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
HEADLIGHT FACTORS AND NIGHTTIME VISION Final Report, Jun. 1974 - Aug. 1976
Carl P. Graf Nov. 1976 102 p refs
(PB-262507/2; HONEYWELL-76-SRC/13; DOT-HS-802102) Avail: NTIS HC A06/MF A01 CSCL 13F

The feasibility of using information concerning driver scan pattern data in the analysis of headlamp effectiveness was examined. The driver-subjects were unaware that their eye movements were being recorded. Eighteen subjects drove over rural two-lane roads with indigenous targets under daytime conditions and six headlight configurations. The major independent variables included headlamp type, target type and reflectivity, road geometry, and glare versus no-glare. Dependent measures were average dwell point, scan pattern distribution, and target detection distance. GRA

N77-24777# Calspan Corp., Buffalo, N.Y.
PERFORMANCE EVALUATION OF THE NHTSA ADVANCED S SERIES 50TH PERCENTILE ANTHROPOMORPHIC DUMMY. VOLUME 1: TECHNICAL REPORT Final Report, Jun. 1975 - Jul. 1976
Daniel E. Massing and Phyllis E. Yates Nov. 1976 293 p refs
(Contract DOT-HS-5-01260)
(PB-262672/9; CALSPAN-ZS-5778-Vol-1; DOT-HS-802073-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 13L

The two series anthropomorphic test dummies were experimentally evaluated to: (1) determine the degree of conformance to specifications for dimensions, segment weights, and joint range of motion, (2) to compare measured component static and dynamic characteristics to requirements, and (3) to establish by sled testing in typical restraint and crash environments their experimental repeatability. Four 30 MPH sled test configurations were employed, type 2 belt, air bag, energy absorbing steering column, and simulated instrument panel with Type 1 belt. The findings of a statistical study of repeatability and reproducibility of experimental results are presented. A thin film piezoelectric pressure sensor was evaluated. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N77-24778 California Univ., Berkeley.
DIGITAL REPRESENTATION FOR STORAGE AND EDITING OF LINE DRAWINGS Ph.D. Thesis
Nicholas Sigismuud Szabo 1976 203 p
Avail: Univ. Microfilms Order No. 77-4350

Methods for the digital storage, retrieval, and editing of engineering drawings and technical illustrations are discussed. Two methods to represent images are described, both of which derive their data from a digital raster scan of the image. The first method represents images by a combination of run-length encoding and line-to-line comparison. To achieve data compression, the Huffman code is modified to reduce the code book size from several thousand entries to approximately 30. It is shown that for typical engineering drawings, the efficiency of the modified code approaches the entropy limit to within a few percent. By simulating the compression algorithms it is shown that 1.5 million bits are required after compression for large drawings of average complexity. This amount of data corresponds to a compression ratio of 50:1. Dissert. Abstr.

N77-24779 Princeton Univ., N. J.
DIGITAL-OPTICAL SIGNAL PROCESSING Ph.D. Thesis
Jan Phillip Allebach 1976 177 p
Avail: Univ. Microfilms Order No. 77-4776

Signal processing problems that lie at the interface between the digital and optical regimes are considered. Problems in the areas of digital holography and the binary representation of continuous tone are discussed. An approach to spectrum shaping, in which the maximum of the spectrum is minimized subject to a constraint on the bandwidth, is considered. The results can be applied to a variety of methods of digital holography. A lower bound for the maximum and a figure of merit are obtained. Practical methods for minimax shaping of the spectrum are described and compared. The effect of aliasing error in digital holography is analyzed and methods are proposed for suppressing it. A process for eliminating the defects found in periodically halftoned images is also described. Dissert. Abstr.

N77-24780*# M&S Computing, Inc., Huntsville, Ala.
SAIL INTELLIGENT TERMINAL EVALUATION Final Report
J. L. Pruitt 18 Mar. 1977 34 p
(Contract NAS8-31714)
(NASA-CR-150263; Rept-77-030) Avail: NTIS HC A03/MF A01 CSCL 09B

Engineering assessments, recommendations, and equipment necessary to solve the operational problems are described, and operational flexibility of the intelligent terminal facility are extended. The following capabilities were considered: (1) the operation of at least two D/D stations and one remote graphics terminal simultaneously; (2) the capability to run plotter, AIDS and FORTRAN programs simultaneously; (3) simultaneous use of system utility routines of D/D stations and remote graphics terminal; (4) the capability to provide large volume hardcopy of data and graphics; and (5) the capability to eliminate or at least ease the current operation/programming problems with related labor costs. The overall intelligent terminal development, and plans guiding the analysis and equipment acquisitions were studied, and the assessments and analyses performed are also summarized. Author

N77-24781*# National Aeronautics and Space Administration. Pasadena Office, Calif.
DIGITAL DATA REFORMATTER/DESERIALIZER Patent Application
Alexander Engel (JPL) and L. Richard Springer, inventors (to NASA) (JPL) Filed 18 Mar. 1977 21 p
(Contract NAS7-100)
(NASA-Case-NPO-13676-1; US-Patent-Appl-SN-779415) Avail: NTIS HC A02/MF A01 CSCL 09B

A method and apparatus is described for reformatting and

deserializing a serially-received sequence of data words, each consisting of a fixed number of binary data bits. A block of nm bits is serially fed into a shift register or serially-connected group of shift registers. In lieu of the (nm - 1)th shift, the bits are rearranged within the shift register in parallel fashion, according to a prescribed scheme. Shifting continues, until the first bit of each data word appears in the last bit position in the shift register, at which time that data word is shifted in parallel into an output buffer stage, from which it is outputted in parallel, after a fixed delay. NASA

N77-24782# Argonne Universities Association, Ill.
USING MORTRAN TO TRANSLATE FORTRAN PROGRAMS FROM ONE MACHINE TO ANOTHER
S. C. Pieper 29 Sep. 1976 35 p refs
(Contract W-31-109-eng-38)
(ANL/PHY-76-3) Avail: NTIS HC A03/MF A01

The MORTRAN processor was slightly modified, and a new set of macros was written, to act as an aid in the translation of IBM FORTRAN programs to CDC FORTRAN. A 30,000-source-card program was sucessfully converted by using the resulting package. The capabilities and limitations of this approach to FORTRAN conversion are described, and two examples of the output of the package are given. ERA

N77-24783# Environmental Monitoring and Support Lab., Las Vegas, Nev.
FORMAT FOR ACQUIRING RAPID DATA ANALYSIS CAPABILITIES OF STORET DATA: MANIPULATION OF NATIONAL EUTROPHICATION SURVEY WATER QUALITY DATA Interim Report, 1972 - 1976
J. D. Bliss, M. J. Friedland, and J. Hodson Nov. 1976 20 p refs
(PB-262995/4; EPA-600/4-76-057) Avail: NTIS HC A02/MF A01 CSCL 13B

As an integral part of the National Eutrophication Survey, a program initiated in 1972 to investigate the threat of accelerated eutrophication of freshwater lakes and reservoirs, the Environmental Monitoring and Support Laboratory, Las Vegas, collected water quality information from selected lakes throughout the contiquous United States. Water quality data are categorized and stored using a U.S. Environmental Protection Agency central computer-oriented system, STORET (STOrage and RETrieval). A need for raw data conversions in STORET to some other accessible form was recognized. A job control language package, 'STORET.TO. WYLBUR.' was written for conversion of raw data in STORET into a standardized format for statistical evaluation and manipulation of Survey data. GRA

N77-24784# National Bureau of Standards, Washington, D. C. Inst. for Computer Sciences and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: FOREIGN AND DOMESTIC ACCOMPLISHMENTS IN MAGNETIC BUBBLE DEVICE TECHNOLOGY Final Report, 1967 - 1975
Robert B. J. Warner and Peter J. Calomeris Jan. 1977 54 p refs
(PB-263123/2; NBS-SP-500-1; LC-76-608386) Avail: NTIS HC A04/MF A01 CSCL 09B

The status of magnetic bubble technology is assessed as displayed by non-U.S. research and manufacturing facilities. Non-U.S. research and U.S. accomplishments are described while both technical and economic factors are addressed. Magnetic bubble devices are discussed whenever their application could impact future computer system design. Generally the magnetic bubble device can be applied to a computer system as a peripheral mass memory. Magnetic bubble devices are produced from either synthetic garnet or amorphous materials rather than from familiar silicon material. A significant bibliography is presented to support certain main points which are supplemented by Information supplied by the library of the Information Technology Division and from private interviews with various U.S. technical experts. GRA

N77-24785# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
ANNOTATION AND CONTROL SUBROUTINE SUBPROGRAMS FOR INTERACTIVE GRAPHIC DISPLAYS
Larmon S. Isom 5 Nov. 1976 59 p refs
(DA Proj. 1X3-63310D074)
(AD-A034231; RG-77-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

Recently, numerous digital computer simulation programs have been developed and/or modified to incorporate the usage of the interactive computer graphics terminal system into their resulting output. The interactive computer graphics terminal system is used primarily to obtain interactive graphic displays as a portion of the simulation program output results. These displays are ideal for data analysis, data reduction and retention, and for inclusion within presentations and technical reports. However, these displays require annotations such that they can be identified at some future date. Certain difficult problems are associated with these annotations and their placement on the interactive graphic displays. Hence, this technical report is an attempt to describe those difficult problems, to provide a technique for their solution, and to acquaint the interactive computer graphics terminal system user of their existence. The use of these techniques and subroutines should make the interactive computer graphic displays more easily annotated and controlled than they have been in the past. GRA

N77-24786# Mitre Corp., Bedford, Mass.
MODULAR C(3) ARCHITECTURE DIGITAL COMMUNICATIONS INTERCONNECT ALTERNATIVES STUDY
L. W. Hill, H. Willensky, and R. C. Labonte Oct. 1976 102 p refs
(Contract F19628-77-C-0001; AF Proj. 6030)
(AD-A034115; MTR-3173; ESD-TR-76-273) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report presents the results of examining and analyzing different design approaches of interconnect systems that would handle the transfer of digital information among consoles, computers, mass storage devices, and similar equipments of future modular tactical command and control centers. GRA

N77-24787# Ohio State Univ., Columbus. Computer and Information Science Research Center.
THE ARCHITECTURE OF A DATABASE COMPUTER. PART 1: CONCEPTS AND CAPABILITIES
Richard I. Baum, David K. Hsiao, and Kannan Krishnamurthi Sep. 1976 53 p refs
(Contract N00014-75-C-0573)
(AD-A034154; OSU-CISRC-TR-76-1-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

A hardware architecture for a database computer (DBC) is given in this paper. The proposed design overcomes many of the traditional problems of database system software and is one of the first to describe a complete data-secure computer capable of handling large databases. GRA

N77-24788# BDM Corp., El Paso, Tex.
DATA BASE MANAGEMENT SYSTEM REFERENCE MANUAL Final Report
James M. Phelan Oct. 1976 143 p refs
(Contract F29601-74-C-0017)
(AD-A034228; AFWL-TR-75-159) Avail: NTIS HC A07/MF A01 CSCL 09/2

The Data Base Management System (DBMS) is a computer program which creates and maintains a hierarchical set of data bases and data base entries in which both the data base structure and the data itself may be defined and controlled by the user. Information stored in the data base is stored as entity attributes. These entities may be placed into ordered sets and inverted linked lists as well as being organized along the normal hierarchical lines of the data base. Information may be retrieved to core storage, system files, and output devices. Author (GRA)

N77-24789# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN OF THE BUS INTERFACE UNIT FOR THE DISTRIBUTED PROCESSOR/MEMORY SYSTEM M.S. Thesis
Robert C. Simpson Dec. 1976 180 p refs
(AD-A034880; GE/EE/76D-40) Avail: NTIS HC A09/MF A01 CSCL 09/2

The Distributed Processor/Memory (DP/M) system is a

concept developed by the Air Force Avionics Laboratory (AFAL). The DP/M system is a decentralized, software programmable Processor Element (PE) which is used to interface the avionics on board an aircraft. Each PE or group of PE's is connected to an aircraft sensor and the PE's are interconnected via a global communication bus. The key characteristic of the DP/M is decentralization (i.e., each avionic interface module, PE, determines when it will access the global bus whereas present systems are controlled by a central computer). This report is in support of a request from AFAL to design the Bus Interface Unit (BIU) of the PE. This study, after defining the BIU requirements in detail, uses the AM2900 Bipolar Microprocessor chip set (Advanced Micro Devices, Sunnyvale, California) to implement the BIU. The hardware, microword format, and data reception microcode were developed. The high-speed and flexibility of the AM2900 chip set as implemented shows that a microprocessor can be used to meet the requirements of a complex hardware system. GRA

N77-24790# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

RELIABILITY MODELS FOR MULTIPROCESSOR SYSTEMS WITH AND WITHOUT PERIODIC MAINTENANCE

Ashok D. Ingle Sep. 1976 42 p refs

(Contracts F44620-73-C-0074; DCA100-75-C-0066; ARPA Order 2466)

(AD-A034854; AFOSR-77-0016TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

Multiprocessor systems, although designed for speed and processing power, lend inherently to redundancy. Appropriately designed distributed intelligence systems that use system reconfiguration and graceful degradation can be substantially more reliable than uniprocessor systems. Reliability models for two multiprocessor systems, C.mmp and Cm*, are presented and compared to a single LSI-11 processor. With the exception of spaceborne systems, most systems may be subjected to tests to ensure proper functioning. When performed regularly, these integrity checks enhance confidence in the system, and its expected mean time to failure. Effect of such periodic maintenance is modeled. The expected life is seen to depend strongly on the efficiency of the tests. The improvement in expected life, however, is observed to be limited by non-redundant parts of a system. Under periodic maintenance, Cm* system offers greater life than C.mmp for tasks allowing considerable redundancy. GRA

N77-24791# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

THE SYMBOLIC MANIPULATION OF COMPUTER DESCRIPTIONS: ISPL COMPILER AND SIMULATOR

Mario R. Barbacci 2 Aug. 1976 76 p refs

(Contract F44620-73-C-0074; Grant NSF GJ-32758)

(AD-A034850; AFOSR-77-0010TR) Avail: NTIS HC A05/MF A01 CSCL 09/2

The compiler described in this manual will translate programs written in a subset of ISP into register transfer level instructions. The code thus generated could be used for the implementation of wiring list generators, simulators, or other Computer Aided Design applications. This manual describes the syntax and semantics of the language (ISPL) accepted by the compiler. The simulator described in this manual will interpret the output of the ISPL compiler, the RTM code, thus allowing the users a generalized computer architecture simulation facility. This manual describes the commands available to the users. GRA

N77-24792# Mathematics and Computation Lab., McLean, Va.

CONFERENCE SYSTEM USER'S GUIDE Final Report

Rod Renner Nov. 1976 31 p refs Sponsored by the Federal Preparedness Agency

(AD-A034738; GSA/FPA/MCL-TM-225-Rev-2) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes three methods of group communication using computer terminals as the vehicle for conducting a group discussion. GRA

N77-24793# California Univ., Los Angeles. Dept. of Computer Science.

IMAGE DATA ORGANIZATION Interim Report

A. Klinger, M. Rhodes, and J. Omolayole 1976 7 p Presented at the San Diego Biomedical Symp. 1976

(Grant AF-AFOSR-2384-72)

(AD-A034339) Avail: NTIS HC A02/MF A01 CSCL 14/3

A magnetic tape conversion program is being developed to facilitate picture processing by medium sized digital computers. The approach is to obtain a revised image format that allows sophisticated algorithms to process small contiguous areas. A tree structure is presented based on regular decomposition of two-dimensional arrays. Magnetic tape capacity parameters are reviewed and applied to develop the best tape organization for this data structure. Alternate neighbor region and partitioning regimes are described and a sample calculation discussed. Author (GRA)

N77-24794# Defense Systems Management School, Fort Belvoir, Va.

MICROPROCESSOR TECHNOLOGY FOR MANAGERS

Stuart G. Mitchell May 1976 59 p refs

(AD-A033919) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report represents the efforts of the author to gain a better understanding of microprocessor technology in early 1976. This field is only six years old and is developing rapidly. By 1980 the microprocessor/microcomputer industry will represent approximately $1 billion annually. A literature survey and interviews with manufacturers and application engineers provided a timely update on this technology. The narrative discusses microprocessor structure and organization, interfacing, capabilities, limitations, and typical applications. Since there are many microprocessors, the Motorola 6800 was chosen as a representative system. The 6800 does not represent a large share of the market currently but appears to be one of the most likely microprocessors to be used in the next few years. In addition to the narrative discussion of microprocessor technology, a glossary of microprocessor terminology, a comprehensive list of microprocessor companies, and an annotated bibliography by year are appended. This report provides the manager with a brief update on microprocessor technology in the 1976 time frame. This information should be updated periodically to be of maximum value. Author (GRA)

N77-24795# Boeing Aerospace Co., Seattle, Wash.

COMPUTER AIDED FUNCTION-ALLOCATION EVALUATION SYSTEM (CAFES) Final Report, 10 Mar. 1975 - 10 Mar. 1976

Richard E. Edwards, Kent S. Renshaw, Michael J. Healy, and Robert A. Atkins Mar. 1976 223 p refs

(Contract N62269-75-C-0239)

(AD-A033856; D180-19338-1) Avail: NTIS HC A10/MF A01 CSCL 09/2

This report documents Phase V accomplishments in a continuing program to develop the Computer-Aided Function Allocation and Evaluation System (CAFES). CAFES is a crew systems design support system based on human engineering methods, computer aids, human performance data, and a data management system. It is intended to support crew systems engineers in systems development from initial mission and requirements analysis through design, test, training and maintenance systems development, as well as in the definition of man-machine research needs. Both the CAFES system and associated computer aids will be applicable to Human Factor activities in all the Navy systems. Author (GRA)

N77-24796# Naval Electronics Lab. Center, San Diego, Calif.

FORACS DATA BANK MANUAL

H. M. Blanchard 15 Oct. 1976 96 p

(AD-A033860; NELC-TD-491) Avail: NTIS HC A05/MF A01 CSCL 09/2

Fleet Operational Readiness Accuracy Check Sites (FORACS) test the performance accuracy of sensors installed aboard ships and submarines. This information is forwarded to NELC for permanent storage on magnetic tape and is subject to rapid recall with respect to desired analysis parameters. Document explains how this effort is conducted. Author (GRA)

N77-24797# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.

MASS MEMORY ORGANIZATION STUDY Final Technical Report, Jul. 1975 - May 1976

D. L. Farnsworth, C. P. Hoffman, and J. J. Shutt Sep. 1976 273 p refs
(Contract F30602-75-C-0317; AF Proj. 5550)
(AD-A033715; NYD-56237-A002; RADC-TR-76-254) Avail: NTIS HC A12/MF A01 CSCL 09/2

The purpose of this study is to develop a recommended organization for gigabit storage device having speed/bandwidth capabilities compatible with an associating type computer processor. Data acquired under this effort is based on the use of nonvolatile MNOS technology integrated circuits. Full exposition is made of the design principles applicable to production of mass memories having optimum data rates and minimal costs for future associative processor applications. Extensive appendices are included on technology impact factors. GRA

N77-24798# Pennsylvania Univ., Philadelphia. Wharton School of Finance and Commerce.
CONVERTING FROM RECTANGULAR TO RELATIONAL DATA BASES Interim Report
David J. Root Sep. 1976 28 p refs
(Contract N00014-75-C-0462)
(AD-A034388; Rept-76-09-09) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes a program developed for the conversion from rectangular to relational data bases. The programs intent is to facilitate loading some segment of a large rectangular file into a relational data base. Thus large rectangular files which could not easily be maintained as relational data bases could have some subset of interest loaded into a relational data base system, such as Rel English, to take advantage of the more powerful relational query languages. The inputs to the conversion routine are the subset of the rectangular file, basic information about the fields in the records, and prototype commands for loading the relational data base. The output is a file of commands for loading the records into the relational data base.
Author (GRA)

N77-24799# Pennsylvania Univ., Philadelphia. Wharton School of Finance and Commerce.
DETERMINISTIC VERSUS NONDETERMINISTIC PROCEDURE FOR AUTOMATIC PROGRAM GENERATION IN DBTG DATA BASE ACCESS
David J. Root Oct. 1976 103 p refs
(Contract N00014-75-C-0462; NR Proj. 049-272)
(AD-A034390; Rept-76-10-01) Avail: NTIS HC A06/MF A01 CSCL 09/2

As information systems grow in scope and size, costs associated with the programming activity are quickly becoming major factors in the economic feasibility of such systems. One obvious solution is to enlist the computer itself to aid in the programming activity. The form of such aid could range from interpreters to program synthesizers (automatic program generation). To date few program synthesizers have been used in real world applications due to either need for more powerful AI techniques to solve the problems involved, or to the costs of the existing AI techniques which they employ. This paper describes the work involved in minimizing the USE OF AI in one such program synthesizer, the Automatic Program Generator (APG), in its application to report generation from network (DBTG) data bases.
Author (GRA)

N77-24800# National Bureau of Standards, Washington, D. C. Inst. for Computer Sciences and Technology.
THE WORLD OF EDP STANDARDS
Marjorie F. Hill (Control Data Corp., Washington, D. C.) and Josephine L. Walkowicz Dec. 1976 156 p refs
(PB-263771/8; NBSIR-77-1195) Avail: NTIS HC A08/MF A01 CSCL 09B

The activities and relationships of the many organizations and individuals involved at the national, regional, and international levels in the development of standards for computers and information processing are described. A generalized description of the standardization process is presented and used as a basis for describing the activities of the principal organizations that comprise the WORLD OF EDP STANDARDS. The description of each organization is structured in a uniform manner and includes the history of each organization, its objectives, membership, organization, finance, relationship to other organizations, and its technical work.
GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-24801 California Univ., Berkeley.
ON THE STABILIZATION OF NEWTON-LIKE ALGORITHMS FOR MIXED SYSTEMS OF EQUATIONS AND INEQUALITIES AND FOR ROOT-FINDING Ph.D. Thesis
Ileana Teodoru Gross 1976 101 p
Avail: Univ. Microfilms Order No. 77-4470

New globally convergent algorithms are presented for solving systems on n equations in n unknowns, and mixed systems of equations and inequalities, respectively. These algorithms are extensions of a number of well-known and of some newly proposed Newton-like locally convergent algorithms. The main feature of these new algorithms is that they stabilize the local procedures, in the sense that they enlarge the domain of convergence from a neighborhood of a solution to a larger region, while preserving the (usually high) rate of convergence of the local method.
Dissert. Abstr.

N77-24802*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
DOCUMENTATION OF GEMASS ENTRY TO TOUCHDOWN SIMULATION
R. H. Waibel 11 May 1977 123 p refs
(Contract NAS9-14960)
(NASA-CR-151362) Avail: NTIS HC A06/MF A01 CSCL 09B

The entry-to-touchdown space shuttle orbiter simulation capability incorporated into the GEMASS subprogram 33 (3-DOF) is documented. A digital autopilot interfaces between GEMASS and the guidance. Vehicle attitude is determined by use of the ability of GEMASS to integrate differential equations in addition to the equations of motion. Vehicle aerodynamic characteristics are obtained from an aerodynamic data tape and control surface deflections required to trim the vehicle, and trimmed aerodynamic coefficients are determined internally. Several indicators to allow evaluation of subsystem performance are included; as is the ability of the user to activate any of several error dispersion sources. The performance of the simulation compares well with more sophisticated simulations.
Author

N77-24803# Aeronautical Research Labs., Melbourne (Australia).
THE SIMULATION LANGUAGE CSMP-10(ARL)
N. E. Gilbert and P. G. Nankivell May 1976 58 p refs
(ARL/Aero-Note-362) Avail: NTIS HC A04/MF A01

The CSMP-10 simulation language was modified by incorporating user-defined clocks written in FORTRAN subroutines, so that a large number of outputs may be defined within these subroutines by using dummy or user output blocks. Two other major improvements were made, both enabling the saving of appreciable core storage. Arrays necessary to store information on each block used are automatically expanded to the size determined by the user. The language is divided into a modeling program, which is used to perform the model simulation and store the output in a binary file on a specified storage device, and an output program, which is used to print and plot the character conversion of the binary file.
Author

N77-24804# Physics Lab. RVO-TNO, The Hague (Netherlands).
DIMENSIONING ANALYSIS OF DMANAGER PARAMETERS USING SIMULATION
G. H. teSligte Jun. 1976 52 p In DUTCH; ENGLISH summary
(PhL-1976-24; TDCK-67958) Avail: NTIS HC A04/MF A01

The simulation of the direct-memory access (DMA) manager (DMANAGER) system, which allows the connection of various devices such as processors, tape units, and typewriter units via one data bus, is described. Timing and buffering problems discovered in the design phase of DMANAGER were resolved.
ESA

N77-24805# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

SUBROUTINES FOR USING THE CALCOMP PLOTTER AND TEKTRONIX VIDEO TERMINALS CONNECTED TO THE HP 2116B COMPUTER [SOTTOPROGRAMMI PER L'USO DEI TERMINALI PLOTTER CALCOMP E VIDEO TEKTRONIX COLLEGATI AL CALCOLATORE HP 2116B]

P. Cerulli-Irelli Jul. 1976 53 p ref In ITALIAN
(LPS-76-21) Avail: NTIS HC A04/MF A01

Several subroutines in the BASIC programming language are described for the use of the Calcomp plotter and Tektronix video terminals connected to the HP 2116 B computer. The language used is BASIC IOB5. ESA

N77-24806# Freiburg Univ. (West Germany). Inst. fuer Physik.

BASEX: A PROGRAMMING LANGUAGE FOR PROCESS AUTOMATION WITH MINICOMPUTERS. DEVELOPMENT AND EXPERIENCE [BASEX: EINE PROGRAMMIERSPRACHE ZUR PROZESSAUTOMATION MIT KLEINRECHNERN - ENTWICKLUNG UND ERFAHRUNGEN]

Wolfgang Schupp Oct. 1976 121 p refs In GERMAN
(Rept-C-35) Avail: NTIS HC A06/MF A01

An extension of BASIC called BASEX (Basic for experiments), this language is intended for real time, small scale applications, e. g., laboratory automation for physical experiments. The BASEX language was implemented on a MINCAL 621 minicomputer and has been applied since 1974. (ESA)

N77-24807# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.

MAKING COMPUTATIONAL SENSE OF MONTAGUE'S INTENSIONAL LOGIC

Jerry R. Hobbs and Stanley J. Rosenschein Dec. 1976 47 p refs
(Contract N00014-75-C-0571)
(AD-A034756; NSO-11) Avail: NTIS HC A03/MF A01 CSCL 05/7

A simplified version of Montague's intensional logic is presented and explicated in terms of computational analogues. Several examples are presented in which Montague's formalism is coupled with a procedural interpretation. A natural translation is given from intensional logic into LISP. The relevance of this research to composition of meaning, knowledge representation, context, and expectation is discussed. Author (GRA)

N77-24808# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Technology Div.

EFFICIENT FORTRAN SUBPROGRAMS FOR THE SOLUTION OF ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS

Paul Swarztrauber and Roland Sweet Jul. 1975 147 p refs
(Contract NSF C-760)
(PB-263498/8; NCAR-TN/109-IA) Avail: NTIS HC A07/MF A01 CSCL 09B

FORTRAN subroutines are presented for the numerical solution of elliptic differential equations in computer models of atmospheric processes. Five of the subroutines solve a Helmholtz equation in various coordinate systems; they solve two-dimensional problems, but can be adapted for use in three-dimensional problems. The other two subroutines can solve a more general class of equation. Solutions of linear systems of equations are discussed in the appendix. GRA

N77-24809# Rice Univ., Houston, Tex. Dept. of Electrical Engineering.

DESIGN OF OPTIMAL FEATURE EXTRACTORS BY MATHEMATICAL PROGRAMMING TECHNIQUES

Rui J. P. DeFigueirdo Jun. 1976 15 p refs
(Grant AF-AFOSR-2777-75; AF Proj. 9769)
(AD-A033722; EE-7608; AFOSR-76-1432TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

In an automatic pattern recognition system, the processor that selects and measures features of the data, on the basis of which classification is made, is called a 'feature selector' or 'feature extractor'. This paper presents a mathematical programming approach for the design of a feature extractor. Author (GRA)

N77-24810# Chicago Univ., Ill. Graduate School of Business.

AN ALGORITHM BASED ON THE EQUIVALENCE OF VECTOR AND SCALAR LABELS IN SIMPLICIAL APPROXIMATION

C. B. Garcia and F. J. Gould Jul. 1976 22 p refs
(Contract N00014-75-C-0495; Grant NSF GS-42010)
(AD-A034022; Rept-7626) Avail: NTIS HC A02/MF A01 CSCL 12/1

A scalar labeling is presented with the property that the complementary path follows the homotopy path tracked by the usual vector labeling. This produces an algorithm which determines the path without pivoting on a linear system and without the extra dimension introduced in the sandwich approach. The results should therefore lead to computational saving. Author (GRA)

N77-24811# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

CLOSED-LOOP CONTROLS FOR DIFFERENTIAL GAMES USING A GRADIENT AND A DIFFERENTIAL DYNAMIC PROGRAMMING METHOD M.S. Thesis

Robert R. Bacon Dec. 1976 83 p refs
(AD-A034875; GA/MC/76D-2) Avail: NTIS HC A05/MF A01 CSCL 12/1

This thesis investigates the use of a gradient method and a combined gradient-differential dynamic programming (DDP) method to generate closed-loop controls for intercept problems formulated as differential games. The gradient method is applied to a planar motion pursuit-evasion game. The trajectory obtained compares favorably with that obtained using analytic expressions for closed-loop controls. The gradient method is applied to a three dimensional interceptor-penetrator game with simplified dynamics on a real-time basis. A combined gradient-DDP algorithm is applied to this problem but not on a real-time basis. The DDP portion of this combined control law was found to be unstable. The results obtained indicate that a gradient based scheme, because of its numerical stability and ability to rapidly converge to the vicinity of the optimum, may be used to generate an effective near-optimal closed-loop control law for some problems. Author (GRA)

N77-24812# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ACQUISITION LOGIC FUNCTION ALGORITHM SPECIFICATION Final Report, 21 Apr. 1975 - 30 Jun. 1976

E. R. Wentz, Jr., H. Mostafavi, H. M. Pearce, D. R. Morgan, and A. I. Cohen Jun. 1976 127 p refs Prepared by Systems Control, Inc., Palo Alto, Calif.
(Contract F19628-76-C-0002; DA Proj. 8X3-63304-D-125)
(AD-A034542; Rept-5140-2; ESD-TR-76-244) Avail: NTIS HC A07/MF A01 CSCL 15/3

This report specifies the software design of an Acquisition Logic Function (ALF) for a monostatic radar, terminal defense, ballistic missile defense system. This report defines the data structure, data flow, and program structure for the ALF simulation software. A separate report, Acquisition Logic Function Analysis and Design, evaluates the algorithms specified in this report. Author (GRA)

N77-24813# Texas Univ., Austin. Center for Numerical Analysis.

IMPROVING THE MANRY-AGGARWAL METHOD FOR DESIGNING MULTI-DIMENSIONAL FIR DIGITAL FILTERS

James W. Daniel Sep. 1976 15 p refs
(Contract N00014-67-A-0126-0015)
(AD-A034541; CNA-114) Avail: NTIS HC A02/MF A01 CSCL 09/3

M. T. Manry and J. K. Aggarwal recently described an algorithm for use in the design of multi-dimensional FIR digital filters by phase correction. As they observe, their method can be viewed as the steepest descent method for minimizing a certain function f(x): given an approximate solution x(n), a new approximation is $x(n+1) = x(n) + t(n)p(n)$ where $p(n) = \text{grad } f(x(n))$ and t(n) is chosen by a simple rule. An improved rule for determining t(n) and an improved direction p(n) (essentially the Fletcher-Reeves conjugate-gradient direction) is derived. The resulting method appears to be two to three times as fast as the Manry-Aggarwal method; the additional cost is primarily in storage which roughly doubles. Author (GRA)

N77-24814# Wisconsin Univ., Madison. Mathematics Research Center.

AUTOMATIC DIFFERENTIATION OF COMPUTER PROGRAMS

G. Kedem Nov. 1976 55 p refs

(Contract DAAG29-75-C-0024)

(AD-A034466; MRC-TSR-1697) Avail: NTIS HC A04/MF A01 CSCL 09/2

A method for the automatic differentiation of computer functions (subroutines) written in a high level language is discussed. A theory is developed to show that most functions that arise in applications can be differentiated automatically. It is shown how one can take FORTRAN function (Subroutine) and, with the aid of a precompiler, obtain a FORTRAN subroutine that computes the original function and its desired derivatives. Implementation of two types of differentiation is described in terms of (1) automatic Taylor series expansion of FORTRAN programs, and (2) automatic Gradient calculation of FORTRAN functions. GRA

N77-24815# Wisconsin Univ., Madison. Mathematics Research Center.

AN EFFECTIVE ALGORITHM FOR QUADRATIC MINIMIZATION PROBLEMS

M. J. Best and K. Ritter Oct. 1976 25 p refs

(Contract DAAG29-75-C-0024)

(AD-A034469; MRC-TSR-1691) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method of conjugate directions is described which solves a quadratic minimization problem in a finite number of steps. Author (GRA)

N77-24816# Rock Island Arsenal, Ill. General Thomas J. Rodman Lab.

MEDIT: A PROGRAM TO EDIT COMPUTER SOURCE PROGRAMS Final Report

James J. Hurt 1 Apr. 1976 38 p

(AD-A034524; RIA-R-TR-76-010) Avail: NTIS HC A03/MF A01 CSCL 09/2

A portable and easily used source text editor is described. This computer utility provides a method to maintain and modify computer source text in a manner that is very easy to use, provides a complete audit trail of changes, and can be used on a wide variety of computers, eg IBM-360-370, CDC-6000, UNIVAC-1100, et al. Author (GRA)

N77-24817# California Univ., Los Angeles. Graduate School of Management.

CHARACTERISTICS OF APPLICATION SOFTWARE MAINTENANCE

B. P. Lientz, E. B. Swanson, and G. E. Tomplins Dec. 1976 22 p refs

(Contract N00014-75-C-0266)

(AD-A034085) Avail: NTIS HC A02/MF A01 CSCL 09/2

Maintenance and enhancement of application software consume a major portion of the total life cycle cost of a system. However, the area has been given little attention in the literature. To analyze the problems in this area a questionnaire was developed and pretested. It was submitted to 120 organizations. Respondents totaled 69. Responses were analyzed using the SPSS statistical package. The results of the analysis indicate that: (1) user demands for enhancements and extensions constitute the major perceived problem area, (2) problems of a management nature are viewed in general as more significant than technical problems, and (3) the use of technical productivity aids remains limited; however, maintenance programmer productivity is not considered by management to be a major problem. Author (GRA)

N77-24818# California Univ., Los Angeles. Graduate School of Management.

MAINTENANCE QUESTIONNAIRE AND LIST OF RESPONDENTS

B. P. Lientz, E. B. Swanson, and G. E. Tomplins Nov. 1976 43 p

(Contract N00014-75-C-0266)

(AD-A034038) Avail: NTIS HC A03/MF A01 CSCL 09/2

There has been an increasing concern with the operational phase of the life cycle of software systems. This phase is concerned with the maintenance and enhancement of computer based information systems. Maintenance is the process of having the system meet the requirements specified in development. Enhancements are changes made to the system to meet new requirements. To analyze these processes a questionnaire was constructed, field tested, and finalized. This report contains that questionnaire, which is divided into the two parts: one dealing with the systems data processing and programming department and the other with a specific application system being maintained and enhanced. The questionnaire includes items of both technical and managerial interest. The questionnaire was distributed to 120 organizations. Responses were collected for 69 applications which are also listed. GRA

N77-24819# Higher Order Software, Inc., Cambridge, Mass.

INTEGRATED SOFTWARE DEVELOPMENT SYSTEM/HIGHER ORDER SOFTWARE CONCEPTUAL DESCRIPTION Final Report, Nov. 1975 - Nov. 1976

M. Hamilton and S. Zeldin Nov. 1976 329 p refs Prepared for Charles Stark Draper Lab., Inc.

(Contract DAAB07-76-C-0329)

(AD-A034086; ECOM-76-0329-F) Avail: NTIS HC A15/MF A01 CSCL 09/2

The Integrated Software Development System/Higher Order Software (ISDS/HOS) is a unified systems engineering methodology that includes a basic set of principles and a standard set of tools and techniques for developing computer-based systems. The foundation of ISDS/HOS is based upon a formal system theory, Higher Order Software (HOS). The principles of ISDS/HOS encompass all phases of system development and all disciplines including design, verification, documentation, management, and maintenance. The automated tools of ISDS/HOS serve to eliminate many possible sources of human error in the transition of system development from concept to deployment. The component tools of ISDS/HOS facilitate the specification of a system, automate interface analysis of the specification, and automate translation of the system specification directly into an optimized target-machine coded form. The ISDS/HOS support tools eliminate much of the manual effort required in the development of computer-based systems. The purpose of this report is to present the ISDS/HOS concept so that managers, systems engineers, and computer scientists can appreciate the various aspects of the basic principles on which ISDS/HOS is based, the basic tools that ISDS/HOS will have available, and the basic techniques that ISDS/HOS users can use. Author (GRA)

N77-24820# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.

TIMING FIGURES FOR INVERTING LARGE MATRICES CONTAINING COMPLEX NUMBERS USING THE STARAN ASSOCIATIVE PROCESSOR Technical Report, Jun. 1975 - Jun. 1976

P. Bruce Berra and Ashok K. Singhania Nov. 1976 72 p refs

(Contract F30602-75-C-0121; AF Proj. 4540)

(AD-A034266; RADC-TR-76-339) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report is a follow on to AD-A009 643, 'Timing Figures for Inverting Large Matrices Using the STARAN Associative Processor.' In that report timing equations were developed for matrices consisting of real numbers whereas this report deals with complex numbers. Algorithms and timing equations are developed for matrices of rank up to 511 and matrices with 512 rank - 1023. Results indicate that it takes 2 1/2 to 4 times longer to invert matrices consisting of complex numbers than it does for real numbers. GRA

N77-24821# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

SOFTWARE DESIGN FOR MULTIMODE MATRIX DISPLAY PERCEPTION TESTS M.S. Thesis

Robert A. Liebach Dec. 1976 109 p refs

(AD-A034273; GE/EE/76-30) Avail: NTIS HC A06/MF A01 CSCL 09/2

The Multi-Mode Matrix Display Program is attempting to test the acceptability of using light-emitting diode displays in

USAF aircraft. The informal and formal functional specifications for the software necessary to perform the desired tests have been developed. Formal functional specifications were developed using a technique called structured analysis. The functional specifications were used to design the software system. This design was accomplished using structured design techniques. The software design is presented using structure charts together with functional descriptions of all modules and definitions of the interfaces between modules. Author (GRA)

N77-24822# Massachusetts Inst. of Tech., Cambridge. Artifical Intelligence Lab.

LAMBDA: THE ULTIMATE DECLARATIVE

Guy Lewis Steele, Jr. Nov. 1976 49 p refs

(Contract N00014-75-C-0643)

(AD-A034090; AI-M-379) Avail: NTIS HC A03/MF A01 CSCL 09/2

In this paper, a sequel to LAMBDA: The Ultimate Imperative, a new view of LAMBDA as a renaming operator is presented and contrasted with the usual functional view taken by LISP. This view, combined with the view of function invocation as a kind of generalized GOTO, leads to several new insights into the nature of the LISP evaluation mechanism and the symmetry between form and function, evaluation and application, and control and environment. It also complements Hewitt's actors theory nicely, explaining the intent of environment manipulation as cleanly, generally, and intuitively as the actors theory explains control structures. The relationship between functional and continuation-passing styles of programming is also clarified. GRA

N77-24823# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

DESIGN TOOLS FOR EVALUATING MULTIPROCESSOR PROGRAMS Ph.D. Thesis

Philip Howard Mason Jul. 1976 204 p refs

(Contract F44620-73-C-0074; ARPA Order 2466)

(AD-A034856; AFOSR-77-0015TR) Avail: NTIS HC A10/MF A01 CSCL 09/2

An approach to designing programs for implementation in a multiple instruction stream-multiple data stream processing environment is presented. A program is modeled as a directed graph consisting of two types of nodes: processing nodes and linking nodes. Communication among nodes in the model is represented by message tokens. Each processing node is similar in form to a semi-Markov process. A simulation of the operation of the model is nondeterministic, but is based on prescribed probabilistic choice functions. A system, called STEPPS, has been built in which a model can be described and evaluation tools can be used to manipulate and act upon a model to predict performance of a program decomposition. The design approach is to describe a multiprocessing program in terms of the modeling system. The model is examined to determine some analytic attributes of the model. The analysis available determines (a) whether the model is well formed, (b) whether the model contains deadlocks, (c) predictions of steady state properties of each process. In addition, without much difficulty, analysis functions external to STEPPS may be included as needed by a program designer. GRA

N77-24824# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

LANGUAGE FOR A DESIGN INFORMATION SYSTEM

Charles Eastman and Max Henrion Aug. 1976 51 p

(Contract F44620-73-C-0074; Grant NSF DCR-73-03492-A01; ARPA Order 2466)

(AD-A034853; AFOSR-77-0014TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

The authors are part of a group which is developing a computerized information system for designing large physical systems. The information system is expected to be useful in the design of buildings, ships, mechanical components, and other entities that normally require drawings, specifications, and a large number of documents for their description and that must respond to a range of diverse analyses. Its purpose is to allow a physical system to be represented within a computer by a single integrated database in sufficient detail for design and construction. It incorporates compact data structures for representing both three-dimensional and other kinds of information. The operations have been organized as a high level computer language. The objective of this language is to allow the user to easily perform the operations required to design within the computer database. In this sense, it is a language for designing. The authors have developed and are implementing such a language, named GLIDE (Graphical Language for Interactive design). This paper describes the semantics and associated syntax of this language. GRA

N77-24825# University of Southern Calif., Marina del Rey. Information Sciences Inst.

THE DESIGN OF DATA TYPE SPECIFICATIONS

John V. Guttag, Ellis Horowitz, and David R. Musser Nov. 1976 28 p refs

(Contract DAHC15-72-C-0308; ARPA Order 2223)

(AD-A034827; ISI/RR-76-49) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report concerns the design of data types in the creation of a software system; its major purpose is to explore a means for specifying a data type that is independent of its eventual implementation. The particular style of specification, called algebraic axioms, is exhibited by axiomatizing many commonly used data types. These examples reveal a great deal about the intricacies of data type specification via algebraic axioms, and also provide a standard to which alternative forms may be compared. Further uses of this specification technique are in proving the correctness of implementations and in interpretively executing a large system design before actual implementation commences. Author (GRA)

N77-24826# Naval Postgraduate School, Monterey, Calif.

ASPECTS OF MICROCOMPUTER STANDARDS Final Report

V. Michael Powers 28 Oct. 1976 18 p refs

(AD-A033720; NPS-52PW76101) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Navy must have standards to aid designers in their choice of microcomputer designs. High-level applications and system programming languages have several advantages in microcomputer design for a wide variety of applications. Author (GRA)

N77-24827# Softech, Inc., Waltham, Mass.

EVALUATION OF ALGOL 68, JOVIAL J3B, PASCAL, SIMULA 67 AND TACPOL VS. TINMAN REQUIREMENTS FOR A COMMON HIGH ORDER PROGRAMMING LANGUAGE Final Report, Jul. - Oct. 1976

John B. Goodenough, Clement L. McGowan, and John R. Kelly Dec. 1976 77 p

(Contract DAAB07-75-C-0373)

(AD-A033893; ECOM-75-0373-F) Avail: NTIS HC A05/MF A01

This report evaluates how well ALGOL 68, JOVIAL J3B, PASCAL, SIMULA 67, and TACPOL satisfy the Department of Defense requirements for high order computer programming languages. GRA

N77-24828# Aerospace Corp., El Segundo, Calif. Development Operations.

MICROPROGRAM VERIFICATION AND VALIDATION Interim Report, Jul. - Dec. 1975

Donald Reifer Feb. 1976 55 p refs

(Contract F04701-75-C-0076)

(AD-A033792; TR-0076(6112)-4; SAMSO-TR-76-217) Avail: NTIS HC A04/MF A01 CSCL 09/2

Microprogramming has emerged as a central attribute of the small-to-medium-scale computers embedded within both military and industrial systems. Among the principal reasons contributing to the rapid growth of this technology and its wide application are that it is easy both to incorporate changes to a design and to emulate consistently another computer. Unfortunately, there exist many similarities between microprogramming technology as it exists today and the state of the art of software technology as it existed twenty years ago. Presently, microprograms are developed by highly personnel who are familiar with the inner workings of the target computer. Considerable interest in developing improved methods for microprogram verification and validation has appeared because of the impact microprograms

have on the reliability of total computer system. The purpose of this report is to document results of recent investigation conducted to determine what the state of the art of microprogram verification and validation is and how it might be improved. Current methods and promising new techniques are reported and an assessment of the technology is made. GRA

N77-24829# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
THE APPLICATION OF DIFFUSION APPROXIMATIONS TO THE STUDY OF TIME-SHARING COMPUTER SYSTEMS AND TRANSITORY QUEUEING SYSTEMS Progress Report, 1 Jan. - 1 Dec. 1976
John P. Lehoczky 1976 4 p refs
(Grant AF-AFOSR-2642-74; AF Proj. 2304)
(AD-A033968; AFOSR-76-1407TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report outlines progress in research in developing diffusion approximations as a general tool for studying stochastic systems and in analyzing a number of complex systems of particular Air Force interest. GRA

N77-24830# Stanford Univ., Calif. Dept. of Operations Research.
COMPUTER PROGRAMS FOR DECOMPOSITION IN INTEGER PROGRAMMING
Gary A. Kochman Sep. 1976 167 p refs
(Contracts N00014-76-C-0418; DAAC29-74-C-0034; F44620-74-C-0034; NR Proj. 047-061)
(AD-A033948; SU-TR-71) Avail: NTIS HC A08/MF A01 CSCL 09/2

This report gives documentations for two computer coded, DSLC and DMLC for solving block angular integer programming problems. The first code, DSLC, is for the single linking constraint case, and the second DMLC is for the multiple linking constraint case. Author (GRA)

N77-24831# Human Engineering Labs., Aberdeen Proving Ground, Md.
DIGIVUE PLASMA PANEL SOFTWARE Final Report
Richard S. Camden Nov. 1976 10 p refs
(AD-A033913; HEL-TN-7-76) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes the system and graphic software written to add a gas-plasma-panel display device as an integral part of the U. S. Army Human Engineering Laboratory (HEL) interactive-graphics system. (GRA)

N77-24832# Naval Underwater Systems Center, New London, Conn.
FORTRAN PROGRAM FOR LINEAR PREDICTIVE SPECTRAL ANALYSIS OF A COMPLEX UNIVARIATE PROCESS
Albert H. Nuttall 3 Dec. 1976 42 p refs
(AD-A034395; NUSC-TR-5505) Avail: NTIS HC A03/MF A01 CSCL 09/2

A Fortran program for evaluating (1) the linear predictive complex filter coefficients and (2) the power density spectrum of a complex univariate process is presented, and its use is demonstrated. A pitfall of using this approach for estimating the cross-spectrum of two real processes is pointed out, and a limitation of the complex predictive filter for waveform estimation is considered. Author (GRA)

62 COMPUTER SYSTEMS

Includes computer networks.

N77-24833 California Univ., Berkeley.
A SYSTEMATIC STUDY OF COMPUTER SYSTEM RELIABILITY Ph.D. Thesis
Yih-Wu Han 1976 221 p
Avail: Univ. Microfilms Order No. 77-4474

Design and operational problems related to fault-tolerant system design as well as system testing were considered. Specific subjects studied included a modular architecture which achieves both high reliability and high maintainability, cost effective design methodology for ultra reliable digital systems, path generation algorithms for systematic program testing, automated program testing techniques, and a unified reliability model to represent both hardware and software system structure. Dissert. Abstr.

N77-24834*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ROBOT LEARNING AND ERROR CORRECTION
Leonard Friedman 15 Apr. 1977 30 p refs
(Contract NAS7-100)
(NASA-CR-153202; JPL-Publ-77-16) Avail: NTIS HC A03/MF A01 CSCL 09B

A model of robot learning is described that associates previously unknown perceptions with the sensed known consequences of robot actions. For these actions, both the categories of outcomes and the corresponding sensory patterns are incorporated in a knowledge base by the system designer. Thus the robot is able to predict the outcome of an action and compare the expectation with the experience. New knowledge about what to expect in the world may then be incorporated by the robot in a pre-existing structure whether it detects accordance or discrepancy between a predicted consequence and experience. Errors committed during plan execution are detected by the same type of comparison process and learning may be applied to avoiding the errors. Author

N77-24835# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
CONDITIONS FOR THE CONTROLLABILITY OF CONSTRAINED LINEAR AUTONOMOUS SYSTEMS ON TIME INTERVALS OF ARBITRARY LENGTH
M. Pachter and P. H. Jacobson Jul. 1976 25 p refs
(CSIR-SR-WISK-210; ISBN-0-7988-0922-1) Avail: NTIS HC A02/MF A01

An Autonomous linear control system was considered without assuming that the origin in R sup m was interior to convhull (omega). Attention was given to null-controllability (controllability of each point in some neighborhood of the origin) on the time interval (0,t) where $t > 0$ but was otherwise arbitrary. Continuity of the minimum time function was also considered. Author

N77-24836# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
ON THE ADJOINT SITUATIONS BETWEEN BEHAVIOUR AND REALIZATION
G. Naude Aug. 1976 24 p refs
(WISK-221) Avail: NTIS HC A02/MF A01

Following the Arbib-Manes approach to machines in categories, the categories Mach(C) of machines and TBeh(C) of total behaviors are constructed, where C is a class of state-behavior processes. It is shown that the total external behavior functor E : Mach(C) approaches TBeh(C) has a left adjoint and that the free realization of any total behavior is reachable. Furthermore, the restriction of E to the full subcategory of Mach(C) with all reachable machines as objects has as right adjoint the minimal realization functor. Author

N77-24837# California Univ., Los Angeles. Dept. of Computer Science.
ADVANCED TELEPROCESSING SYSTEMS Semiannual Technical Report, 1 Jan. - 30 Jun. 1976
Leonard Kleinrock, Gerald Estrin, Richard Muntz, and Gerald Popek 30 Jun. 1976 408 p refs
(Contract DAHC15-73-C-0368)
(AD-A034171) Avail: NTIS HC A18/MF A01 CSCL 09/2

This research deals with the specification, analysis and evaluation of some routing and topology design procedures for large store and forward packet switched computer communication networks. The procedures studied are an extension of present techniques and rely on a hierarchical clustering of the network nodes. Hierarchical adaptive routing schemes are investigated in the context of large networks. A hierarchical design methodology is also presented as a solution for the reduction of the computational cost involved in the topological design of large networks. A computational cost model is developed in order to determine that clustering structure which achieves a minimal cost. Such optimal structures are found which lead to very significant savings in computation. GRA

N77-24838# Massachusetts Computer Associates, Inc., Wakefield.
NATIONAL SOFTWARE WORKS, VOLUME 1 Status Report, 1 Jul. 1975 - 29 Feb. 1976
Robert Millstein Griffiss AFB, N. Y. RADC Sep. 1976 217 p refs
(Contracts F30602-76-C-0094; N00014-75-C-0093)
(AD-A034133; CADD-7603-0411-Vol-1; RADC-TR-76-276-Vol-1; SR-1) Avail: NTIS HC A10/MF A01 CSCL 09/2

The National Software Works NSW is a facility, resident on the ARPANET, intended to support the construction, use, maintenance, modification, verification, and storage of programs and bodies of information on which these programs operate. It is principally aimed at the construction of programs and at providing software tools which can be used in the construction activity. NSW is intended to facilitate both the administrative and technical aspects of these activities. Thus, it provides mechanisms for the exercise of fiscal and access control in the operation of a programming project, and also access and storage conveniences to programmers for the management of their files. The salient factor in the conception of NSW is the expectation that the hardware, software and human resources for the execution of a task may be geographically and administratively dispersed, although connected through the network. Tools whose use is to be coordinated may be resident at different computer installations, possible under the control of different organizations, each with its own rules of operation. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N77-24839 Missouri Univ., Columbia.
NUMERICAL METHODS FOR ABSOLUTE STABILITY ANALYSIS Ph.D. Thesis
Byung Ju Min 1976 227 p
Avail: Univ. Microfilms Order No. 77-4935

The absolute stability of both continuous-time and discrete-time automatic control systems is discussed. A numerical method for finding the absolute stability sector of a nonlinear control system with a single, separable nonlinearity was determined. A formulation and algorithm for the absolute stability of higher-order Pulse Width Modulated (PWM) control systems are presented. Dissert. Abstr.

N77-24840 California Univ., Berkeley.
FINITISTIC CODING AND EXPECTED CODING TIME Ph.D. Thesis
Khosrow Dehnad 1976 82 p
Avail: Univ. Microfilms Order No. 77-4431

The following results are given: (1) if E(P',P) is less than infinity and P is weakly Bernoulli for T, then P will also be weakly Bernoulli for T; (2) the expected coding time for the Meshalkhin coding is infinite; (3) given T, there exists P so that (T,P) is not finitely codable from any (T,P) for which [T to the i power] i = 0, ± 1, ± 2, is a Markov process (or even n-step Markov process for any n); (4) there exists a coding of any n-step Markov process from a Bernoulli process, which is finite and has finite expected coding time. Dissert. Abstr.

N77-24841 British Library Lending Div., Boston Spa (England).
THE METHOD OF THE APPROXIMATE SYNTHESIS OF OPTIMUM CONTROL ON THE PHASE SURFACE
A. V. Priezhev and V. B. Shmalgeusen [1976] 10 p refs Transl. into ENGLISH from Izv. VUZ Priborostr. (Leningrad), no. 12, 1973 p 39-45 In ENGLISH and RUSSIAN
(BLL-M-24840-(5828.4F)) Avail: NTIS Avail: British Library Lending Div., Boston Spa, Engl.

A method is given for obtaining near optimal control of a dynamic system of the second order under various quality conditions, using consecutive approximations. An algorithm for approximate synthesis control is analyzed under the assumption that the controlling influence is confined to an absolute value. The algorithm is optimal in the sense of a minimum of integral function with differing penalty functions. Author

N77-24842 British Library Lending Div., Boston Spa (England).
CRITERIA OF APERIODICITY OF AUTOMATIC CONTROL SYSTEMS
A. V. Mikhailov [1976] 27 p refs Transl. into ENGLISH from Avtomat. Telemekh. (USSR), no. 1, 1941 p 21-32
(BLL-M-24870-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A criterion of aperiodicity for linear automatic systems is put forward based on the principle of breaking the control circuits. By means of a concrete example it is shown that the practical application of the criterion of aperiodicity is most suitable for systems with lumped on constants. Author

N77-24843*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ALGORITHMS FOR ADAPTIVE STOCHASTIC CONTROL FOR A CLASS OF LINEAR SYSTEMS
M. Toda and R. V. Patel Apr. 1977 43 p refs
(NASA-TM-X-73240; A-7030) Avail: NTIS HC A03/MF A01 CSCL 09B

Control of linear, discrete time, stochastic systems with unknown control gain parameters is discussed. Two suboptimal adaptive control schemes are derived: one is based on underestimating future control and the other is based on overestimating future control. Both schemes require little on-line computation and incorporate in their control laws some information on estimation errors. The performance of these laws is studied by Monte Carlo simulations on a computer. Two single input, third order systems are considered, one stable and the other unstable, and the performance of the two adaptive control schemes is compared with that of the scheme based on enforced certainty equivalence and the scheme where the control gain parameters are known. Author

N77-24844# European Space Agency, Paris (France).
CONTRIBUTIONS TO THE DESIGN OF LINEAR CONTROL LAWS AND REDUCED-ORDER MODELS BY MINIMIZING A QUADRATIC COST FUNCTIONAL
Winfried Hofmann Apr. 1977 107 p refs Transl. into ENGLISH of 'Beitr. zum Entwurf linearer Regelgesetze u. von Systemmodellen reduzierter Ordnung durch Minimierung eines quadratischen Guetekriteriums', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-FB-76-39, 19 Jul. 1976 Original report in GERMAN previously announced as N77-13717 Original German report available from DFVLR, Cologne DM 43,50
(ESA-TT-340; DLR-FB-76-39) Avail: NTIS HC A06/MF A01

The formulation of the design of linear control laws and reduced-order models using a quadratic cost functional represents an advantageous setup which permits influencing the behavior of certain variables and leads to numerically suitable solution procedures. Design procedures of linear control laws for high-order systems and for given stability constraints are derived. The design of reduced-order models includes known initial conditions and inputs with known autocorrelation function. Author (ESA)

N77-24845# Brown Univ., Providence. R. I. Lefschetz Center for Dynamical Systems.
PERTURBED STOCHASTIC LINEAR REGULATOR PROBLEMS Interim Report
Chun-Ping Tsai 1976 38 p refs
(Grant AF-AFOSR-3063-76; AF Proj. 2304)
(AD-A033832; AFOSR-76-1409TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned with the approximate solution of stochastic optimal control problems which arise by perturbing the stochastic linear regulator problem, through an additive term with a small parameter delta in the drift coefficient of the unperturbed dynamical equations. The system states are assumed completely observable. The main results concern expansions of solutions of the perturbed equation in powers of the small parameter delta. GRA

N77-24846# Southeastern Massachusetts Univ., North Dartmouth. Dept. of Electrical Engineering.

A MODIFIED GRADIENT TECHNIQUE FOR IMAGE ANALYSIS Interim Report
C. H. Chen 15 Sep. 1976 32 p
(Grant AF-AFOSR-2951-76; AF Proj. 2304)
(AD-A032750; EE-76-5; AFOSR-76-1205TR) Avail: NTIS HC A03/MF A01 CSCL 20/6

The modified gradient operation considered in this report takes the product of four conventional gradient operations in four different directions. Such modified procedure is shown by extensive computer results to provide great improvement in noise reduction and boundary extraction over the conventional gradient operation. Furthermore, the procedure is computationally simple and insensitive to rotation of images. Computer results of modified gradient operation followed by image compression are also presented. Author (GRA)

N77-24847# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
INFERENCE FOR TRANSITION NETWORK GRAMMARS
S. M. Chou and K. S. Fu 1976 8 p refs Presented at 3d Intern. Joint Conf. on Pattern Recognition, 8-11 Nov. 1976
(Grant AF-AFOSR-2661-74; AF Proj. 2304)
(AD-A034063; AFOSR-76-1308TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

This paper gives a brief introduction to transition networks and proposes an approach to the inference of transition network grammars. Author (GRA)

N77-24848# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
THE USE OF GROUP-THEORETIC CONCEPTS IN SOLVING PROBLEMS IN ESTIMATION AND CONTROL
Alan S. Willsky 1976 10 p refs
(Grant AF-AFOSR-2273-72)
(AD-A034064; AFOSR-76-1309TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

In this paper some results obtained over the past few years in the areas of estimation and control are described. The point of this research is to find subclasses of systems that possess sufficient structure to allow the determination of optimal solutions or computationally feasible algorithms. In particular, several results from group theory (both for Lie and finite groups) are utilized to obtain our results. Author (GRA)

N77-24849# Pattern Analysis and Recognition Corp., Rome, N. Y.
THE WAVEFORM PROCESSING SYSTEM (WPS), VOLUME 1 Final Technical Report
Probal K. Sanyal and Donald H. Foley Griffiss AFB, N. Y. RADC Oct. 1976 118 p refs
(Contract F30602-72-C-0193)
(AD-A034417; PAR-76-12-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report constitutes the Final Technical Report for the Waveform Processing System (WPS) developed by Pattern Analysis and Recognition Corporation for the Rome Air Development Center. The Waveform Processing System consists of (1) algorithms for performing mathematical operations on waveform data, (2) a language for extracting feature vectors from the waveform, and (3) algorithms for analyzing these vectors to develop pattern classification logic. Author (GRA)

N77-24850# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPUTER IDENTIFICATION OF PHONEMES IN CONTINUOUS SPEECH M.S. Thesis
William R. Hensley Dec. 1976 140 p refs
(AD-A034274; GE/EE/76-24) Avail: NTIS HC A07/MF A01 CSCL 17/2

The purpose of this investigation was to identify phoneme segments as they appeared in continuous speech. The input device was an audio tape recorder from which the analog speech signal was digitized and fast Fourier transformed. The amplitudes of this transformed signal were combined in a logarithmic manner and printed out in a 16 channel digitized spectrogram. Sixty-one prototypes were selected to represent the phonemes of the English language. These prototypes were stored and used in a running crosscorrelation with the unknown speech signal. The amplitude values resulting from the correlation process were used to predict phoneme locations, and the values were compared in order to identify the correct phoneme. The phonemes were selected from Speaker A's speech signal, and tests were conducted to analyze utterances from Speaker A and Speaker B. For Speaker A, location was rated at 81 percent while identification was rated at 45 percent. For Speaker B, location was found to be 70 percent with identification at 40 percent. Spatial filtering techniques, uniform length prototypes, and various normalization procedures were investigated next with the result of improving location for Speaker B. Author (GRA)

N77-24851# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF ALPHANUMERIC SYMBOL LEGIBILITY DETERMINATION BY USE OF FOURIER SPATIAL FREQUENCY COMPONENTS M.S. Thesis
Harvey D. Dahljelm Dec. 1976 63 p refs
(AD-A034279; GE/EE/76D-20) Avail: NTIS HC A04/MF A01 CSCL 09/3

Legibility is of fundamental importance in pattern recognition. Legibility of five sets was predicted by using maximum-minimum Euclidean distance of separation in a feature space spanned by truncated, two-dimensional, discrete Fourier spatial frequency components of alphanumeric symbols. For a symbol pair, as distance of separation increased the number of errors decreased and the majority of the errors occurred within the five nearest symbols to the symbol. GRA

N77-24852# Massachusetts Inst. of Tech., Cambridge.
EXPERIMENTS IN TEXTURE PERCEPTION Annual Report, 1 Jun. 1975 - 31 May 1976
Whitman A. Richards Jul. 1976 42 p refs
(Contract F44620-74-C-0076; ARPA Order 2765)
(AD-A033834; AFOSR-76-1312TR) Avail: NTIS HC A03/MF A01 CSCL 06/16

Over the past year, a special graphics display has been constructed to further research in texture perception. This display has the ability to produce 440 x 440 point patterns consisting of complex (computer-generated) sinusoidal modulations of luminance that may be altered every 20 msec. A section of this report describes the 9 subsystems of the display, and elaborates its other capabilities, such as on-line variation of 100 x 100 random-dot (Julesz) patterns. With this display, the process of determining the minimum number of spatial frequencies necessary to 'match' one and two dimensional textures is now in progress. Because such textures can be described exactly in terms of their Fourier components, the task is to determine just how many of these components are necessary to lead an observer to believe that the partially reconstructed texture is, in fact, the complete physical representation. At present, for linear one and two-dimensional texture patterns, only four spatial frequencies are sufficient to produce 'texture metamers', at least for normal TV viewing conditions. Work is currently in progress to determine the generality of this finding, particularly for texture patterns composed of sinusoidal products. Author (GRA)

N77-24853# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
THE EFFICIENCY OF CERTAIN PRODUCTION SYSTEM IMPLEMENTATIONS Interim Report
J. Mcdermott, A. Newell, and J. Moore Sep. 1976 35 p refs
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A034851; AFOSR-77-0011TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

There has recently been considerable investigation in Artificial Intelligence of a class of control structures called production systems. Production systems provide one alternative for how to organize an intelligence system. This paper is concerned with the efficiency of implementation of production systems. If implemented straightforwardly according to their definition (as is done in most initial and demonstration versions), they are quite expensive, especially for large systems. Thus, alternative implementations must be developed. In this paper the authors explore several schemes and give some experimental results.
GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-24854 Oklahoma State Univ., Stillwater.
ESTIMATION OF A LINEAR REGRESSION MODEL WHEN THE VARIANCE IS A LINEAR FUNCTION OF UNKNOWN PARAMETERS Ph.D. Thesis
Huei Chu Tsai 1976 88 p
Avail: Univ. Microfilms Order No. 77-5203

This thesis is devoted to estimating the regression coefficients and variance components in a linear regression model when the variance is a linear function of unknown parameters. In order to obtain homoscedasticity in a linear regression model when the variance is a linear function of unknown parameters, a maximum rank transformation matrix was constructed. A consistent and unbiased estimator of the vector of regression coefficients is developed with variance smaller than the estimator based on ordinary least squares when the relative size of the largest variance to the smallest variance in the regression model is large. The variance components are estimated by combing the orthonormal bases of error spaces technique and the proposed maximum rank transformation technique. Dissert. Abstr.

N77-24855 Michigan Univ., Ann Arbor.
NON-SELFADJOINT SEMILINEAR PROBLEMS IN THE ALTERNATIVE METHOD Ph.D. Thesis
Patrick Joseph McKenna 1976 78 p
Avail: Univ. Microfilms Order No. 76-27543

The existence of solutions to abstract operator equations of the form Ex = Nx where E is a linear, not necessarily bounded, operator and N is a nonlinear operator, and both are defined on subsets of a suitably chosen Banach space are considered. The case where E is a nonselfadjoint is considered, and in this case a way of splitting the equation into an auxiliary and bifurcation equation is produced. A substantial amount of what was previously known only for the selfadjoint case is generalized to non-selfadjoint equations. These results are applied to non-self adjoint problems at resonance including the difficult case where the Fredholm indices of E are not equal. Dissert. Abstr.

N77-24856 California Univ., Berkeley.
GROUP C*-ALGEBRAS AND SQUARE-INTEGRABLE REPRESENTATIONS Ph.D. Thesis
Jonathan Micah Rosenberg 1976 102 p
Avail: Univ. Microfilms Order No. 77-4586

The group C^*-algebras of the ax + b groups are determined over all nondiscrete locally compact fields and of a number of two-step solvable Lie groups, obtaining in particular, characterizations of all but two of the C^*-algebras which arise as $C^*(G)$ for G, a three-dimensional connected solvable Lie group. Let G be a locally compact group with center Z. Even when G is not unimodular or type I, factor representations of G with at least one square-integrable coefficient (resp. one coefficient square-integrable modulo Z) are the same as representations quasi-equivalent to factor subrepresentations of the left regular representation of G (resp. of representations of G induced from characters of Z). Such representations are called square-integrable in the strong (resp. weak) sense, or S.I.S.S. (S.I.W.S.) for short. These representations obey orthogonality relations similar to the classical ones for unimodular groups. For connected Lie groups, a method is given for determining, in principle, all S.I.W.S. factor representations of G up to quasi-equivalence.
Dissert. Abstr.

N77-24857 Michigan State Univ., East Lansing.
A PERTURBATION TECHNIQUE FOR ORDINARY DIFFERENTIAL EQUATIONS WITH PERIODIC COEFFICIENTS Ph.D. Thesis
Israel Lindenfeld 1976 114 p
Avail: Univ. Microfilms Order No. 77-5847

Conditions under which solutions of a certain class of second order ordinary differential equations with periodic coefficients are bounded were studied. The stability of the solutions of a system of two coupled second order ordinary differential equations with periodic coefficients was investigated using classical Floquet theory. These differential equations arise by considering the influence of a harmonically varying torsion moment on a rotating shaft carrying a disc. A perturbation technique was developed which gives rise to systems of differential equations which can be solved exactly leading to algebraic equations of degree greater than or equal to 2 with complex coefficients. The technique was applied to various problems. Dissert. Abstr.

N77-24858 California Univ., Berkeley.
CONSTRUCTING FRAMED 4-MANIFOLDS WITH GIVEN ALMOST FRAMED BOUNDARIES Ph.D. Thesis
Steven Jarson Kaplan 1976 48 p
Avail: Univ. Microfilms Order No. 77-4492

A method is presented for constructing framed, simply connected 4-manifolds where the boundary, an oriented, almost framed 3-manifold, is given. The Rohlin invariant of an almost framed 3-manifold was computed. The given 3-manifold is regarded as the boundary of a 4-dimensional handlebody with a single zero handle and all other handles of index 2.
Dissert. Abstr.

N77-24859 Southern Illinois Univ., Carbondale.
MEASURES WITH ORTHOGONAL VALUES Ph.D. Thesis
Victor Henry Gummersheimer 1976 80 p
Avail: Univ. Microfilms Order No. 77-6221

A measure phi with orthogonal values (on disjoint sets) is a countably additive set function whose domain is a sigma-algebra of subsets of X and whose images span a dense set in a Hilbert space in which images of disjoint sets are orthogonal. A spectral measure E is a countabiy additive set function on a sigma-algebra of subsets whose images are self-adjoint projections on a Hilbert space and E(X) is the identity map. To each measure with orthogonal values is associated a spectral measure such that phi(A) = E(A)phi(X) for each A in the common domain of phi and E. This representation permits the application of results on spectral measures to measures with orthogonal values and vice versa. The topics treated from this point of view are extension theory, indefinite integrals, absolute continuity, equivalence, and mutual singularity. Dissert. Abstr.

N77-24860# Lockheed Missiles and Space Co., Palo Alto, Calif.
USE OF THE FINITE ELEMENT METHOD IN MODELING EFFECTS ORIGINATING IN THE MOIRE METHOD
V. G. Mil'kov and N. I. Mil'kova 1976 6 p refs Transl. into ENGLISH from Zvdla. USSR (Moscow), v. 43, no. 3, Mar. 1977 p 342-345
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The finite element method permits the construction of lines of equal displacement in modeling Moire effect, and in analyzing the relative shift in the control and working rasters which must be taken into account in strain field investigations. Two methods for considering the relative shift when processing differential Moire patterns are developed. The correctness of the fringe sign determination by the finite element method is illustrated in solving an elastic-plastic problem about the tension of a strip with a hole. A strain diagram obtained during the tension of a smooth duraluminum specimen at t=175 C was used in the computation. Author

N77-24861*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
EXACT SOLUTION OF SOME LINEAR MATRIX EQUATIONS USING ALGEBRAIC METHODS
T. E. Djaferis and S. K. Mitter May 1977 24 p refs
(Grant NGL-22-009-124; Contracts E(49-18)-2087; N00014-75-C-0661)
(NASA-CR-153056; ESL-P-746) Avail: NTIS HC A02/MF A01 CSCL 12A

A study is done of solution methods for Linear Matrix Equations including Lyapunov's equation, using methods of modern algebra. The emphasis is on the use of finite algebraic procedures which are easily implemented on a digital computer and which lead to an explicit solution to the problem. The action f sub BA is introduced a Basic Lemma is proven. The equation PA + BP = -C as well as the Lyapunov equation are analyzed. Algorithms are given for the solution of the Lyapunov and comment

is given on its arithmetic complexity. The equation P - A'PA = Q is studied and numerical examples are given. S.S.

N77-24862# Royal Aircraft Establishment, Farnborough (England).
CUBATURE FORMULAE WITH MINIMUM NUMBER OF NODES
H. M. Moeller Dec. 1976 26 p refs Transl. into ENGLISH from Numer. Math. (West Ger.), v. 25, 1976 p 185-200
(RAE-LIB-Trans-1910; BR56781) Avail: NTIS HC A03/MF A01

For two-fold integrals, a lower bound is derived for the number of nodes in a cubature formula of degree 2s - 1. There is a formula of degree 2s - 1 for which the number of nodes attains this lower bound, if a certain condition is fulfilled. By this condition, all formulae of degree 2s - 1 with that minimal number of nodes can be constructed. Examples and a generalization to the n-dimensional case are given. Author

N77-24863# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
AUTOMATIC STEPSIZE CONTROL IN THE SOLUTION OF PARABOLIC EQUATIONS BY EXPONENTIAL FITTING IN TIME
D. P. Laurie Oct. 1973 16 p refs
(CSIR-SR-WISK-126) Avail: NTIS HC A02/MF A01

The technique of exponential fitting is particularly useful for solving certain parabolic differential equations, the nature of the solution of which is known. Consideration of the leading term in the error estimate yields an expression for the step size to be used. A posteriori analysis of the computed solution yields estimates for the fitting parameter which allow very large time steps after the transient stage. Numerical examples are given. Author

N77-24864# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
PROOF OF A CONJECTURE OF MORENO ON EXPONENTIAL POLYNOMIALS
F. R. Wadleigh May 1976 20 p refs
(CSIR-SR-WISK-205) Avail: NTIS HC A02/MF A01

Let the exponential polynomial phi (S) = sum between the limits of k = 1, and n of A sub k e superscript alpha k to the s power, s = sigma + it, with constant complex coefficients A sub k, have real frequencies alpha sub 1,..., alpha sub n which together with 1, are linearly independent over the rationals. Moreno proved that the real parts of the zeros of phi (s) are dense in the open interval. Moreno's conjecture that similar results are true for complex alpha sub k is proved. An application to differential-difference equations is given. Author

N77-24865# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A CRITERION FOR OPTIMALITY OF DESIGN OF EVOP-TYPE EXPERIMENTS
T. J. Stewart Jul. 1976 24 p refs
(CSIR-SR-WISK-207) Avail: NTIS HC A02/MF A01

A criterion for optimality of experimental design is developed by means of response surface models. The formulation of the basic decision model, and the computational methods for application of the criterion are discussed along with a modified criterion for nonquadratic response surfaces. F.O.S.

N77-24866# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A COMPARISON STUDY OF A NEW ALGORITHM FOR FUNCTION MINIMIZATION
C. A. Botsaris Jul. 1976 37 p ref
(CSIR-SR-WISK-214) Avail: NTIS HC A03/MF A01

The numerical results, obtained on testing an algorithm for function minimization, are presented and discussed. For comparison reasons the IBM Scientific Subroutine Package version of Fletcher's algorithm was also run for the same test functions and starting points. The new algorithm for function minimization was coded in FORTRAN IV and executed on the CDC CDC CYBER 174 computer of the CSIR. Author

N77-24867# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A CLASS OF METHODS FOR UNCONSTRAINED MINIMIZATION BASED ON STABLE NUMERICAL INTEGRATION TECHNIQUES
C. A. Botsaris Jul. 1976 34 p refs
(CSIR-SR-WISK-215) Avail: NTIS HC A03/MF A01

Algorithms were derived which minimize a nonlinear function by iteratively constructing a monotonically improving sequence of approximate minimizers along curvilinear search paths instead of rays. These curvilinear search paths were obtained by solving a first-order approximation to certain initial value systems of non-linear differential equations. The simplest technique for solving some of the above systems numerically, viz that of Euler, yields either the steepest-descent or Newton method, and this included the examination of the possibility of modifying other, more sophisticated and stable numerical integration techniques for use in function minimization. Theoretical as well as practical aspects of using numerical integration techniques in order to derive minimization algorithms are presented. Results are given and possible areas for future research indicated. Author

N77-24868# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
CURVILINEAR OPTIMIZATION METHOD BASED UPON ITERATIVE ESTIMATION OF THE EIGENSYSTEM OF THE HESSIAN MATRIX
C. A. Botsaris Jul. 1976 28 p refs
(CSIR-SR-WISK-217) Avail: NTIS HC A03/MF A01

An iterative procedure requiring gradient information only is developed for the approximation of the eigensystem of the Hessian matrix. It is shown that for a quadratic function the approximated eigenvalues and eigenvectors tend rapidly to the actual eigenvalues and eigenvectors of its Hessian matrix. The numerical tests indicate that the resulting algorithm is fast and stable. Moreover, the fact that some approximations to the eigenvectors of the Hessian matrix are available is used to get past saddle points and accelerate the rate of convergence on flat functions. Author

N77-24869# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
DIFFERENTIAL GRADIENT METHODS
C. A. Botsaris Jul. 1976 36 p refs
(CSIR-SR-WISK-216) Avail: NTIS HC A03/MF A01

A class of recently developed differential descent methods for function minimization is presented and discussed, and a number of algorithms are derived which minimize a quadratic function in a finite number of steps and rapidly minimize general functions. The main characteristics of the algorithms are that a more general curvilinear search path is used instead of a ray and that the eigensystem of the Hessian matrix is associated with the function minimization problem. The curvilinear search paths are obtained by solving certain initial-value systems of differential equations, which also suggest the development of modifications of known numerical integration techniques for use in function minimization. Results obtained on testing the algorithms on a number of test functions are also given and possible areas for future research indicated. Author

N77-24870# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
CHARACTERIZATION OF PRIMITIVE SOLUTIONS OF LINEAR PARTIAL DIFFERENTIAL EQUATIONS
Abraham Ungar Jul. 1976 10 p refs
(SIR-SR-WISK-218; ISBN-0-7988-0930-2) Avail: NTIS HC A02/MF A01

Primitive solutions of linear partial differential equations are characterized in a theorem, which is proved by using the technique of the differential transform. Author

N77-24871# Wisconsin Univ., Madison. Mathematics Research Center.
GENERAL ESTIMATES FOR LINEAR FUNCTIONALS IN NONLINEAR PROBLEMS Technical Summary Report
M. J. Sewell and B. Noble Dec. 1976 69 p refs
(Contract DAAG29-75-C-0024)
(AD-A034475; MRC-TSR-1703) Avail: NTIS HC A04/MF A01 CSCL 12/1

A general theory for estimating linear functionals in nonlinear problems is given, in terms of the gradients of a generating Lagrangian functional. The theory is illustrated by finding bounds on the deflection of a nonlinear cantilever beam. Author (GRA)

N77-24872# University of Southern Calif., Los Angeles. Dept. of Mathematics.

QUALITATIVE PROPERTIES OF DIFFERENTIAL EQUATIONS Final Report, 15 Sep. 1973 - 15 Sep. 1976

H. A. Antosiewicz, W. A. Harris, Jr., and R. J. Sacker 15 Oct. 1976 6 p refs

(Grant DAHC04-74-G-0013)

(AD-A034012; ARO-11655.5-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Research was carried out in several broad areas: existence theory for generalized differential equations and general linear boundary value problems for nonlinear differential equations; singular perturbation problems and the theory of asymptotic integration; and dynamical systems and skew-product flows. Author (GRA)

N77-24873# Naval Underwater Systems Center, Newport, R. I.

A METHOD FOR THE NUMERICAL SOLUTION OF A PARTICULAR SET OF COUPLED ORDINARY DIFFERENTIAL EQUATIONS

Gary T. Griffin 7 Dec. 1976 17 p refs

(ARPA Order 2976; NUSC Proj. A-696-70)

(AD-A034112; NUSC-TR-5383) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method by which a particular set of coupled ordinary nonlinear differential equations may be solved numerically is presented. The nonlinearity is present due to the quadratic terms present in the derivatives. An example is given to illustrate the problem when applied to a model of a cable towed body moving through a viscous fluid. GRA

N77-24874# Naval Undersea Center, San Diego, Calif.

WINDOWS, HARMONIC ANALYSIS AND THE DISCRETE FOURIER TRANSFORM Research and Development Report, May - Aug. 1976

Fredric J. Harris Sep. 1976 70 p refs

(AD-A034956; NUC-TP-532) Avail: NTIS HC A04/MF A01 CSCL 12/1

The discrete Fourier transform implemented by means of the fast Fourier transform has become a primary processing tool for harmonic detection and harmonic analysis. The relationships between bandwidth and sample rate and between resolution and observation interval are supposedly well known to the practicing engineer. Real-world harmonic analysis requires the use of a window (other than the rectangle) to assure consistency and confidence in the harmonic estimates. Applying a window to observed data affects the detectability, resolution, confidence, and bias of the estimates. It has been observed that the trade-offs available through the use of windows are not well understood nor popularly appreciated in the literature or by the practitioner. In addition, the requirement to apply windows to sampled data often leads to subtle misapplications of the windows. This paper, tutorial and informational, will identify the major considerations, effects, and pitfalls of which the signal processor should be aware. We will also identify and clarify points of common misunderstanding concerning sampled windows. Author (GRA)

N77-24875# Air Force Academy, Colo. Frank J. Seiler Research Lab.

OPTIMAL AND SUBOPTIMAL RESULTS IN FULL AND REDUCED ORDER LINEAR FILTERING

Robert B. Asher and Craig S. Sims Dec. 1976 26 p refs

(AD-A034398; FJSRL-TR-76-0022) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper considers the synthesis of linear reduced order filters and the synthesis of linear full order filters with minimum complexity. The objective of a reduced order filter is to estimate a linear transformation of the state vector with a filter of lower dimension. This type of filter occurs frequently in applications. Several cases are studied. In a number of cases it is shown that singular arcs exist. In instances where certain filter parameters are not subject to optimization, it is shown that the remaining parameters can be optimized with a relatively simple procedure. Closed form solutions for a number of cases have been obtained. Author (GRA)

N77-24876# Wisconsin Univ., Madison. Mathematics Research Center.

CONTROLLABILITY AND STABILITY THEORY FOR LINEAR PARTIAL DIFFERENTIAL EQUATIONS; RECENT PROGRESS AND OPEN QUESTIONS

David L. Russell Nov. 1976 217 p refs

(Contract DAAG29-75-C-0024)

(AD-A034463; MRC-TSR-1700) Avail: NTIS HC A10/MF A01 CSCL 12/2

This paper is an assessment of the current state of controllability and observability theories for linear partial differential equations, summarizing existing results and indicating open problems in the area. Author (GRA)

N77-24877# Wisconsin Univ., Madison. Mathematics Research Center.

A LEAST-ELEMENT THEORY OF SOLVING LINEAR COMPLEMENTARITY PROBLEMS AS LINEAR PROGRAMS

Richard W. Cottle and Jong-Shi Pang Dec. 1976 39 p refs

(Contract DAAG29-75-C-0024; Grant NSF MCS-75-17385)

(AD-A034464; MRC-TSR-1702) Avail: NTIS HC A03/MF A01 CSCL 12/1

In a previous report the authors have established a least-element interpretation to Mangasarian's theory of formulating some linear complementarity problems as linear programs. In the present report, a previous analysis to a more general class of linear complementarity problems investigated in Mangasarian is carried out. This report demonstrates how solutions to these problems can be generated from least elements of polyhedral sets and investigates how these 'least-element solutions' are related to the solutions obtained by the linear programming approach as proposed by Mangasarian. GRA

N77-24878# Wisconsin Univ., Madison. Mathematics Research Center.

DIFFERENCE METHODS FOR STIFF ORDINARY DIFFERENTIAL EQUATIONS

Heinz-Otto Kreiss Nov. 1976 69 p refs

(Contract DAAG29-75-C-0024)

(AD-A034465; MRC-TSR-1699) Avail: NTIS HC A04/MF A01 CSCL 12/1

Consider the initial value problem for a first order system of stiff ordinary differential equations. The smoothness properties of its solutions are investigated and a general theory for difference approximations is developed. Author (GRA)

N77-24879# Wisconsin Univ., Madison. Mathematics Research Center.

THE EXISTENCE OF A NON-NEGATIVE SOLUTION OF AN ORDINARY DIFFERENTIAL EQUATION ARISING IN ELECTROMAGNETIC THEORY

J. B. McLeod Sep. 1976 23 p ref

(Contract DAAG29-75-C-0024)

(AD-A034484; MRC-TSR-1681) Avail: NTIS HC A02/MF A01 CSCL 12/1

The existence of a non-negative solution of the boundary-value problem is proved by a shooting argument. The equation arises in an electromagnetic theory for strong interaction in charged media. GRA

N77-24880# Wisconsin Univ., Madison. Mathematics Research Center.

AN ABSTRACT NONLINEAR VOLTERRA INTEGRODIFFERENTIAL EQUATION

M. G. Crandall, S.-O. Londen, and J. A. Nohel Sep. 1976 57 p refs

(Contract DAAG29-75-C-0024; Grant DAHC04-74-G-0012)

(AD-A034483; MRC-TSR-1684) Avail: NTIS HC A04/MF A01 CSCL 12/1

The nonlinear Volterra equation was studied as well as the corresponding problem with infinite delay. Under various assumptions on the nonlinear operators A, B and on the given functions a, F, f, h existence theorems are obtained for nonlinear

volterra equation and nonlinear volterra equation with infinite delay, followed by results concerning boundedness and asymptotic behavior of solutions on (0 less than or equal to t less than infinity); two applications of the theory to problems of nonlinear heat flow with infinite memory are also discussed. GRA

N77-24881# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
MARKOV DECISION PROCESSES WITH POLICY CONSTRAINTS
John Nafeh Apr. 1976 166 p refs
(Grant NSF GK-36491)
(AD-A034249; SU-EES-DA-76-3) Avail: NTIS HC A08/MF A01 CSCL 12/1

This work is concerned with Markov Decision Processes with policy constraints. The selection of an optimum stationary policy for such processes, in the absence of policy constraints, is a problem which has received a great deal of attention, and has been satisfactorily solved. Relatively little attention has been given to the case when policy constraints are present or to the formulation of such constraints. Optimum policy sensitivity analysis is also a subject in which little has been achieved. Towards those ends, this work makes three major contributions. First, policy constraints are formulated and categorized. Secondly, a computationally efficient iterative algorithm is developed for selecting the optimum policy for completely ergodic, infinite time horizon Markov Decision Processes with policy constraints for both the risk-indifferent and risk-sensitive cases. Finally, the sensitivity of optimum policies to the policy constraints is analyzed by using the algorithm to compute the value of removing a constraint or a group of constraints. Author (GRA)

N77-24882# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FACTORIAL AND HADAMARD SERIES FOR BESSEL FUNCTIONS OF ORDERS ZERO AND ONE
Alexander S. Elder and Emma M. Wineholt Dec. 1976 22 p refs
(DA Proj. 1W6-62618-AH-80)
(AD-A034434; BRL-MR-2705) Avail: NTIS HC A02/MF A01 CSCL 12/1

Bessel functions of orders zero and one for moderate and large positive arguments have been programmed in FORTRAN using factorial series for J sub N X, Y sub N X and K sub N X and Hadamard series for I sub N X. A subroutine to calculate Stirling numbers of the first kind was developed for use in the factorial series. The recurrence relation was modified and the resulting stirling numbers scaled so that the entire range of the computer was utilized e.g., 10 to the minus 150th power S 10 to the 150th power instead of S 10 to the 150th power. In this way, more terms of the series can be calculated and higher accuracy obtained. For use in the Hadamard series, a subroutine to calculate incomplete gamma functions was developed. Various algorithms were necessary to encompass the required range of arguments. These programs were devised to verify the accuracy for moderate and large arguments of our previously developed Bessel function subroutine. These programs replace the asymptotic series with convergent series, which, of course, is desirable. Extension of the program to complex arguments is now in progress. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-24883 Carnegie-Mellon Univ., Pittsburgh, Pa.
A BAYESIAN APPROACH TO THE ANALYSIS OF STATIONARY TIME SERIES Ph.D. Thesis
Robert Wayne Shore 1977 167 p
Avail: NTIS Avail: Univ. Microfilms Order No. 77-5027

The analysis of time series data from a Bayesian point of view is examined. A parameterization is emphasized, in which the reciprocal spectral density is assumed to be a finite linear combination of known functions. The coefficients of the linear combination are the parameters. The ARMA parameterization and a parameterization which uses a finite number of the ordinates of the spectral density are also mentioned briefly from the Bayesian point of view. A procedure for computing an approximate conditional density for future observations given only the observed time series is given. Dissert. Abstr.

N77-24884 Wisconsin Univ., Madison.
MODELS FOR BIVARIATE DIRECTIONAL DATA AND ANGULAR-LINEAR DATA WITH APPLICATIONS TO STATISTICAL INFERENCE Ph.D. Thesis
Thomas Edward Wehrly 1976 120 p
Avail: Univ. Microfilms Order No. 76-28183

The description and measurement of dependence and correlation of bivariate directional data and of angular-linear data are discussed. Some new models for bivariate directional and angular-linear data are developed, and these distributions form the basis for inference on the dependence of circular random variables. Some parametric models for correlation on the torus are developed. Existing methods of forming univariate circular models are extended to bivariate circular distributions. Of major interest is a new class of distributions on the torus having specified marginal distributions. The induced dependence relations of the two variables for these distributions are studied. Dissert. Abstr.

N77-24885 New York Univ., N. Y.
A SIGNED MEASURE ON PATH SPACE CORRESPONDING TO THE EQUATION DELTA u/DELTA t = (-1) TO THE n+1 POWER DELTA TO THE 2n POWER u/DELTA X TO THE 2n POWER Ph.D. Thesis
Kenneth J. Hochberg 1976 64 p
Avail: Univ. Microfilms Order No. 77-5412

The connection between the heat equation and the Brownian motion (Weiner process) is generalized to processes related to the higher order equation delta u/delta t=(-1) to the (n+1) power delta to the 2n power u/delta x to the 2n power, with n greater than or equal to 2. The stochastic integral between limits 0 and t of Phi(x(s))(dx) to the j power (s), for j=1,2,...2n, is defined, and an analogue of Ito's lemma for the Brownian integral is proven. Specifically, it is shown that there are 2n independent differentials (dx) to the j power, with (dx) to the 2n power=(-1) to the n+1 power (2n) factorial dt. Applications of the Ito lemma include the derivation of the Martingale solution of dy=alpha y dx, and a class of orthogonal functions which generalize the Hermite polynomials. The distribution of the maximum function and the acrsine law are derived using Spitzer's identity and the Feynmann-Kac formula. Finally, a version of the central limit theorem is proven for convergence of sums of independent random variables identically distributed by a signed measure, normalized to have 2n-1 moments equal to zero and 2n-th moment equal to (-1) to the n+1 power (2n) factorial. Dissert. Abstr.

N77-24886 British Library Lending Div., Boston Spa (England).
STATISTICAL ADDITION OF DEVIATIONS FROM NOMINAL VALUES
A. Tolk 29 Nov. 1976 10 p refs Transl. into ENGLISH from Tech. Mitt. RFZ (West Ger.), v. 17, no. 3, 1976 p 80-81 (BLL-PO-3400-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Parameters and their tolerances for sections of a transmission system, so that requirements may be fulfilled for the whole system, are examined theoretically. The derivations give clearly recognizable relationships which must be observed in the tolerancing and measurement of channel parameters as well as in the development and testing of equipment. Author

N77-24887*# Houston Univ., Tex. Dept. of Mathematics.
SUFFICIENT STATISTICS FOR MIXTURES OF MEASURES IN A HOMOGENEOUS FAMILY
C. Peters Mar. 1977 18 p refs
(Contract NAS9-15000)
(NASA-CR-151338; Rept-64) Avail: NTIS HC A02/MF A01 CSCL 12A

Methods for identifying finite mixtures and sets of measures are given. Theorems and corallaries are provided for characterizing sufficient statistics for analysis. A.R.H.

N77-24888# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).

ESTIMATORS BASED ON TWO ORDERED OBSERVATIONS, FOR THE SHAPE PARAMETER OF THE WEIBULL DISTRIBUTION

R. Markham Jun. 1976 25 p refs
(CSIR-SR-WISK-209; ISBN-0-7988-0911-6) Avail: NTIS HC A02/MF A01

Estimators based on two ordered observations are given for the shape parameter of the two-parameter Weibull distribution. Both complete and censored samples are considered. In addition, factors are provided which make it possible to place confidence bounds on the shape parameter. Author

N77-24889# Stanford Univ., Calif. Dept. of Statistics.
A STOCHASTIC CAPACITY EXPANSION MODEL: NON-MODULAR TEMPORARY FACILITIES

R. Scott Shipley 27 Sep. 1976 83 p refs
(Contract N00014-75-C-0561; NR Proj. 042-002)
(AD-A033428; SU-TR-178) Avail: NTIS HC A05/MF A01 CSCL 12/2

This paper considers optimal decision strategies with regard to capacity expansion in an environment where demand arrivals and departures can be characterized as independent Poisson processes. Two types of facilities are considered in the model: permanent and temporary. Permanent facilities represent the means by which demand is normally served, while temporary facilities represent the extraordinary measures taken in order to serve excess demand (prior to an expansion of permanent facilities). Examples of temporary facilities include backlogging, overloading and jobletting. This paper considers non-modular temporary facilities, the costs of which depend only on the amount of excess demand currently being served. A companion paper (17) treats the case of modular temporary facilities. For a given limit (K) on temporary facility usage, the form of the expected discounted cost functional, parameterized in the expansion size (X-1), is derived. Recursions are given for determining these functionals over all feasible values for K. GRA

N77-24890# Stanford Univ., Calif. Dept. of Operations Research.
A STOCHASTIC CAPACITY EXPANSION MODEL: MODULAR TEMPORARY FACILITIES

R. Scott Shipley 4 Oct. 1976 84 p refs
(Contract N00014-75-C-0561; NR Proj. 042-002)
(AD-A033343; SU-TR-179) Avail: NTIS HC A05/MF A01 CSCL 12/2

This paper considers optimal decision strategies with regard to capacity expansion in an environment where demand arrivals and departures can be characterized as independent Poisson processes. Two types of facilities are considered in the model: permanent and temporary. Permanent facilities represent the means by which demand is normally served, while temporary facilities represent the extraordinary measures taken in order to serve excess demand (prior to an expansion of permanent facilities). Examples of temporary facilities include backlogging, overloading and jobletting. This paper considers modular temporary facilities which typically are available in a fixed increment size (a module) and incur instantaneous installation and removal charges in addition to normal usage costs. Because of these additional charges, a sub-optimization problem arises with regard to how modules should be used so as to properly balance the instantaneous charges with the usage costs in order to minimize overall expected costs. It is shown that an optimal module removal policy has the form: 'remove a model only if at least s^* additional units of unused capacity will remain available.' A simple algorithm is given for determining the optimal parameter s^*. GRA

N77-24891# Polytechnic Inst. of New York, Brooklyn. Dept. of Electrical Engineering and Electrophysics.
MEASUREMENT AND CONTROL OF QUEUES AND OTHER MARKOV SYSTEMS Final Report, Sep. 1973 - Aug. 1976

Leonard Shaw Nov. 1976 15 p refs
(Grant NSF ENG-73-03802-A01)
(PB-262788/3; EE/EP-76-021) Avail: NTIS HC A02/MF A01 CSCL 12B

An analysis is given of stochastic modelling and control problems motivated by engineering problems in vehicular and message traffic control, reliability and maintenance, and evolution of user demand for public services. Results relate to optimal diversion of customers around traffic queues, optimal assignment of service rate to queues, optimal inspections and replacement procedures for deterioration parts, and development of simulation models for growth of usage of a new transportation system. GRA

N77-24892# Decisions and Designs, Inc., McLean, Va.
INTERACTIVE GRAPHICAL AIDS FOR BAYESIAN HIERARCHICAL INFERENCE Final Report

Scott Barclay Dec. 1976 87 p
(Contract F30602-76-C-0156)
(AD-A034598; RADC-TR-76-308; TR-76-9) Avail: NTIS HC A05/MF A01 CSCL 12/1

Bayesian hierarchical inference is an optimum methodology for diagnosing the probable state of an unknown variable from data which are known, but which are only indirectly related to the variable of interest. The present report describes a general procedure for Bayesian hierarchical inference implemented on an interactive graphics computer. It allows an intelligence analyst to build a hierarchical inference tree structure, assess the required probability distributions, and compute the likelihood distribution over the target variable. The procedure allows variables to be either discrete, such as the type of research being pursued by a foreign government, or continuous, such as the personnel strength of a foreign tank regiment. Author (GRA)

N77-24893# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
THE USE OF SPHERICAL HARMONICS IN SUBOPTIMAL ESTIMATOR DESIGN Interim Report

Steven I. Marcus and Alan S. Willsky 1976 8 p refs
(Grants AF-AFOSR-2273-72; NSF GK-42090)
(AD-A034062; AFOSR-76-1310TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

The state estimation problem for bilinear stochastic systems evolving on sphere is considered. The problem is motivated by some applications involving rotational processes in three dimensions. Then the theory of harmonic analysis on spheres is used to define assumed density approximations which result in implementable suboptimal estimators for the state of the bilinear system. Author (GRA)

N77-24894# Wisconsin Univ., Madison. Mathematics Research Center.
ESTIMATION OF A MIXING DISTRIBUTION FUNCTION

J. R. Blum and V. Susarla Oct. 1976 22 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-76-05952)
(AD-A034468; MRC-TSR-1690) Avail: NTIS HC A02/MF A01 CSCL 12/2

Let script a = (f(., Theta)/Theta epsilon j); J an interval, is a family of univariate probability densities on an interval I. A necessary and sufficient condition is given for a to be identifiable. If f sub G is a G-mixture of densities in script a with G unknown, an estimator G sub n based on f sub G and script a is provided so that G sub n (yields w) G. Results are applied to location and scale parameter families of densities and to empirical Bayes decision. Author (GRA)

N77-24895# Wisconsin Univ., Madison. Mathematics Research Center.
APPLICATION OF INTERVAL ANALYSIS TO ERROR CONTROL

J. M. Yohe Sep. 1976 16 p refs
(Contract DAAG29-75-C-0024)
(AD-A034480; MRC-TSR-1686) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper gives simple examples of ways in which interval arithmetic can be used to alert instabilities in computer algorithms, roundoff error accumulation, and even the effects of hardware inadequacies. This paper is primarily tutorial. GRA

N77-24896# Princeton Univ., N. J. Dept. of Statistics.
THE MINIMUM OF HIGH ORDER GAPS

Noel Cressie Aug. 1976 15 p refs
(Contracts N00014-75-C-0453; N00014-67-A-0151-0017)
(AD-A034354; TR-116-Ser-12) Avail: NTIS HC A02/MF A01 CSCL 12/1

A large body of theory exists for statistics based on gaps or spacings. This paper shows that a natural generalization to gaps of higher order, results in statistics for testing uniformity which have higher power. In particular the null and alternative distributions of the minimum gap statistic are derived, and the power of the test is seen to increase with m. Author (GRA)

N77-24897# California Univ., Los Angeles. Dept. of Energy and Kinetics.
STATISTICAL MODELS FOR COMPETING RISK ANALYSIS
Harland N. Sather Aug. 1976 70 p refs
(Grants NSF GI-39416; NSF OEP-75-20318)
(PB-264181/9; UCLA-ENG-7676; NSF/RA-760308) Avail: NTIS HC A04/MF A01 CSCL 18I

Basic statistical relationships underlying the subsequent competing risks model development, and the problem of comparing cause-specific risk structure by competing risks theory in two homogeneous populations, P1 and P2 are discussed. Weibull models are studied for the effect of time on the hazard function. The use of concomitant information for modeling single-risk survival is extended to the mulitple failure mode domain of competing risks. The model used to illustrate the use of this methodology is a life table model which has constant hazards within predesignated intervals of the time scale. Parametric models for bivariate dependent competing risks, which provides interesting alternatives, are proposed and examined. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N77-24898# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF DIFFERENTIAL DYNAMIC PROGRAMMING TO AN AIR-TO-AIR MISSILE GUIDANCE PROBLEM MODELED AS A DIFFERENTIAL GAME M.S. Thesis
Albert H. Ferraris Dec. 1976 108 p refs
(AD-A034896; GA/MC/76D-7) Avail: NTIS HC A06/MF A01 CSCL 12/1

An intercept problem between an air-to-air missile and an aircraft is modeled as a zero sum, free final time differential game which includes nonlinear dynamics and a payoff related to the kill probability. Previous research has shown that the currently used guidance scheme, proportional navigation, is nonoptimal in this type of problem formulation and a higher kill probability is possible with a guidance law based upon a differential game theory. A differential dynamic programming method is applied to the intercept problem in the search for a real-time solution. A convergence control procedure is introduced in an attempt to enhance the convergence of the typically long-time solution methods. The closed-loop guidance law which results is compared to both proportional navigation and some exact open-loop solutions by means of an off-line simulation on a CDC 6600 computer. The method does not yield a real-time solution for this problem and does not give improvement over a proportional navigation scheme. Author (GRA)

N77-24899# Wisconsin Univ., Madison. Mathematics Research Center.
THE HOPF-RINOW THEOREM IN INFINITE DIMENSION Technical Summary Report
Ivar Ekeland Oct. 1976 28 p refs
(Contract DAAG29-75-C-0024)
(AD-A034482; MRC-TSR-1692) Avail: NTIS HC A03/MF A01 CSCL 12/2

In this paper, the following theorem is proven. Let M be a complete, possibly infinite-dimensional, Riemannian manifold. Take any point q in M. Then the set of points p epsilon M which can be joined to q by a unique minimal geodesic contains a countable intersection of open dense subsets. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N77-24900 Missouri Univ., Columbia.
SOME CLASSES OF GENERALIZED ALTERNATIVE RINGS Ph.D. Thesis
David J. Pokrass 1976 57 p
Avail: Univ. Microfilms Order No. 77-4947

Various classes of nonassociative rings are studied, each of which satisfies the generalized right alternative law: 0 = g(w,x,y,z) = (wx, y,x) + (w,x,[y,z]) - w(x,y,z) - (w,y,x)x. The first two chapters deal with nilalgebras satisfying, in addition, certain other properties. It is shown that these algebras are nilpotent. Chapter III concerns itself with semiprime rings satisfying the above identity along with two other identities. It is shown that such rings are alternative. In Chapter IV examples of nonassociative rings via a new technique are constructed. In the fifth chapter H is shown that under certain conditions the nucleus equals the center. Dissert. Abstr.

N77-24901 Southern Illinois Univ., Carbondale.
COMPLETIONS OF SPACES OF VECTOR-VALUED MEASURES Ph.D. Thesis
Karl Oscar Rehmer 1976 109 p
Avail: Univ. Microfilms Order No. 77-6252

Let (X,U) be a Hausdorff uniform space and let (E,F) be a pairing of real linear spaces such that F is total over E. Let E be complete for the topology of uniform convergence on the members of some admissible family of subsets of F. Let L(X, F) be the set of molecular measures from X into F. That is, L(X, F) is the set of all functions from X into F which vanish outside a finite subset of X. By using several families of subsets of U((X,U), (E), the space of all uniformly continuous functions from X into E, locally convex topologies are defined on L(X, F). The problems of finding the completions of L(X, F) for these topologies are generalizations of a problem studied by M. Katetov (1965). Grothendieck's completion theorem is used to provide information about the completions of L(X, F) for these topologies. Dissert. Abstr.

N77-24902 Oklahoma State Univ., Stillwater.
SPECTRAL SYNTHESIS IN BANACH MODULES Ph.D. Thesis
John Gilbert Romo 1976 154 p
Avail: Univ. Microfilms Order No. 77-5173

A spectral synthesis theory for Banach modules over regular semisimple commutative Banach algebras is considered. Fundamental properties of spectra are used to develop a spectral synthesis theory in the spirit of that for bounded functions. Sets of synthesis for Banach modules are defined and spectral related problems are formulated, notably (1) a spectral synthesis problem, (2) spectral analysis problem, and (3) closure problem. The impact of the particular topology imposed on the module is apparent in a duality condition introduced: bi-annihilation invariance. This notion is analogous to Kaplansky's dual ring concept. Sets of synthesis for Banach algebras and Banach modules are shown to be equivalent for the class of bi-annihilation invariant modules. The investigation culminates in a Banach module formulation of a Wiener-Ditkin-Shilov Theorem and applications to almost periodicity. In particular, Loomis' characterization of almost periodic elements and a theorem of Beuring regarding convolution equations is obtained for a class of modules. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-24903# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
OPTIMAL CONTROL OF A BROWNIAN MOTION
Herman Chernoff and Albert John Petkau (British Columbia Univ., Vancouver, Canada) 13 Dec. 1976 39 p refs
(Contract N00014-75-C-0555; NR Proj. 042-331)

(AD-A033881; TR-5) Avail: NTIS HC A03/MF A01 CSCL 12/2

The potential function methods are applied to give a more analytic approach to a problem of stochastic control of Brownian motion. This approach is applied also to a generalization of the problem, an application of which involves deciding between two costly modes for reducing a queue length when there is a holding cost and a cost of switching from one mode to another. Some computational methods are indicated. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution.*

N77-24904 Oklahoma State Univ., Stillwater.

I/f NOISE AS A NONSTATIONARY PROCESS Ph.D. Thesis

Jawahar Lal Tandon 1976 102 p

Avail: Univ. Microfilms Order No. 77-5195

From a compilation of the empirical evidence for the existence of I/f noise in a wide variety of systems, a set of hypotheses for the random phenomenon responsible for the generation of I/f noise in a general system was derived. Almost all important approaches to explain I/f noise in the past are discussed and evaluated, and it is found that they do not satisfy one or more of the stipulated hypotheses. The hypotheses together with the analytical properties of stochastic processes were used to arrive at the important conclusion that I/f noise should result from a nonstationary stochastic process. Certain features of such a process were investigated, and a necessary condition for the autocorrelation function of it was developed. An example of a time dependent autocorrelation function for the nonstationary process is given and it is shown that it results in the measured I/f noise satisfying the hypotheses. Dissert. Abstr.

N77-24905# Aeronautical Research Labs., Melbourne (Australia).

ABSORPTION OF TRANSMITTED ULTRASOUND IN BRAGG DIFFRACTION IMAGING

P. A. Doyle Apr. 1976 14 p refs

(ARL/Mat-100) Avail: NTIS HC A02/MF A01

The influence of absorption of the ultrasound in the water of the Bragg cell of the imaging system was studied theoretically. It is shown that the optical image formed was that of a distorted sound field which can be written in terms of the unattenuated acoustical spectrum and geometrical factors. The absorption caused a loss of resolution as well as of sensitivity. Compared wtih the restriction on resolution due to the small numerical aperture of the optical system, this absorption loss increased from only 5.4 percent at 20 MHz to 66 percent at 70 MHz, for a typical experimental arrangement. This loss of resolution could be reduced by increasing the temperature of the water in the Bragg cell. Author

N77-24906*# Tennessee State Univ., Nashville. School of Engineering and Technology.

PULSE ANALYSIS OF ACOUSTIC EMISSION SIGNALS Final Report, 1 Jun. 1974 - 31 May 1976

J. R. Houghton and P. F. Packman Feb. 1977 183 p refs (Grant NsG-8012)

(NASA-CR-153078) Avail: NTIS HC A09/MF A01 CSCL 20A

A method for the signature analysis of pulses in the frequency domain and the time domain is presented. Fourier spectrum, Fourier transfer function, shock spectrum and shock spectrum ratio were examined in the frequency domain analysis, and pulse shape deconvolution was developed for use in the time domain analysis. Comparisons of the relative performance of each analysis technique are made for the characterization of acoustic emission pulses recorded by a measuring system. To demonstrate the relative sensitivity of each of the methods to small changes in the pulse shape, signatures of computer modeled systems with analytical pulses are presented. Optimization techniques are developed and used to indicate the best design parameters values for deconvolution of the pulse shape. Several experiments are presented that test the pulse signature analysis methods on different acoustic emission sources. These include acoustic emissions associated with: (1) crack propagation, (2) ball dropping on a plate, (3) spark discharge and (4) defective and good ball bearings. Deconvolution of the first few micro-seconds of the pulse train are shown to be the region in which the significant signatures of the acoustic emission event are to be found. Author

N77-24907*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL INVESTIGATION ON SOUND TRANSMISSION THROUGH CAVITY-BACKED PANELS

C. Kearney Barton Jun. 1977 14 p refs Presented at the 93d Acoustical Soc. of Am. Meeting, State College, Pa., 7-10 Jun. 1977

(NASA-TM-X-73939) Avail: NTIS HC A02/MF A01 CSCL 20A

Some experimental findings are presented on the effects of panel stiffness and receiving space absorption on low frequency sound transmission through panels into closed spaces. A simplified method for calculating the low frequency noise reduction of a cavity-backed panel is presented. Author

N77-24908# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

BEHAVIOR OF A SONIC BOOM NEAR A CAUSTIC [DAS VERHALTEN EINES UEBERSCHALLKNALLES IN DER UMGEBUNG EINER KAUSTIK]

Frank Obermeier 1976 63 p refs In GERMAN

(MPIS-28/1976) Avail: NTIS HC A04/MF A01; Max-Planck-Inst. fuer Stroemunsforsch., Goettingen, West Ger. DM 12

The behavior of a sonic boom with a short but finite shock rise time was investigated near a caustic (envelope of converging ray tubes). Pressure distributions were approximately calculated using the linear wave theory and results were compared with those from the transonic theory. An equivalence with linearized transonic theories was found. The additional effect of nonlinear terms on the pressure distribution behavior near the caustic is discussed. Methods for improving the agreement between theoretically determined pressure distributions of a focused supersonic boom and the measured values are proposed. ESA

N77-24909# European Space Agency, Paris (France).

ACOUSTIC EMISSION FROM COHERENT STRUCTURES IN A TURBULENT JET

Claude Dahan Mar. 1977 147 p refs Transl. into ENGLISH of 'Emission Acoustique de Struct. Coherentes dans un Jet Turbulent', ONERA, Paris Report ONERA-P-1976-4, 1976 Original report in FRENCH previously announced as ESA-98477 (ESA-TT-364; ONERA-P-1976-4) Avail: NTIS HC A07/MF A01

Measurements of turbulence properties for determining the acoustic far field radiated by a hot free jet in the subsonic range were carried out using radiometers detecting the local infrared emission of the jet. Results were in good agreement with others of the same type but obtained in different ways, in revealing the existence of large-scale motion patterns associated with the instability properties of the jet mixing zone. An experimentation procedure based on analysis of spectral relations between the infrared signal fluctuations and the fluctuations of microphone signals picked up in the near and far pressure fields was therefore devised, and enabled these coherent structures and the sound field associated with them to be determined. Author (ESA)

N77-24910# Utah Univ., Salt Lake City. Dept. of Mathematics.

SPECTRAL AND ASYMPTOTIC ANALYSIS OF ACOUSTIC WAVE PROPAGATION Technical Summary Report

Calvin H. Wilcox Aug. 1976 96 p refs

(Contract N00014-76-C-0276; NR Proj. 041-370)

(AD-A033758; TSR-29) Avail: NTIS HC A05/MF A01 CSCL 20/1

The report presents an exposition of the results of the author's research on acoustic wave propagation during the last five years. The principal result of this research is the 'method of spectral and asymptotic analysis' for determining the structure of

acoustic waves in unbounded media. In this report the method is explained and illustrated by its application to the following four classes of acoustic wave propagation problems: Scattering by bounded obstacles in a homogeneous unlimited fluid; propagation and scattering in simple and compound tubular waveguides; propagation in plane stratified fluids; propagation in crystals. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-24911# Princeton Univ., N. J. Dept. of Chemistry.
INELASTIC MOLECULAR COLLISIONS: APPLICATION OF THEORETICAL METHODS TO PROBLEMS RELEVANT TO LASER OPERATION Progress Report, 1 Feb. 1975 - 1 Nov. 1976
Herschel Rabitz 1 Nov. 1976 15 p refs
(Contract E(11-1)-2542)
(COO-2542-1) Avail: NTIS HC A02/MF A01

Research to develop and evaluate various techniques for the calculation of rotational and vibrational inelastic molecular collisions is described. Effective Hamiltonian theory and decomposition methods for calculating collisional information are described.. ERA

N77-24912# California Univ., Berkeley. Lawrence Berkeley Lab.
PHOTOELECTRON SPECTROSCOPY AND AUGER ELECTRON SPECTROSCOPY OF SOLIDS AND SURFACES Ph.D. Thesis - Calif. Univ., Berkeley
Steven Paul Kowalczyk Jan. 1976 878 p refs
(Contract W-7405-eng-48)
(LBL-4319) Avail: NTIS HC A99/MF A01

The use of photoelectron spectroscopy, primarily X-ray photoelectron spectroscopy, to obtain information on the electronic structure of a wide variety of solids (especially the bulk electronic structure of solids) is covered. Both valence band and core-level spectra, as well as a few cases of photon excited Auger electron spectroscopy, are employed in the investigations to derive information on N(E). The effect of several modulations inherent in the measured I(E)'s, such as final state band structure, cross section, and relaxation, is discussed. Examples of many--electron interactions in PES are given. Some experimental aspects of PES and AES studies are given with emphasis on sample preparation techniques. Multiple splitting of core levels is examined using the Mn levels in MnF2 as a detailed case study. Core level splittings in transition metals, rare earth metals, transition metal halides and several alloys are also reported. The application of PES to the study of the chemical bond in some crystalline semiconductors and insulators, A/sup N/B/sup 8-N/ and A/sup N/B/sup 10-N/ compounds, is treated, and a spectroscopic scale of ionicity for these compounds is developed from the measured s-band splitting in the valence band density of states. ERA

N77-24913# California Univ., Berkeley. Lawrence Berkeley Lab.
RELAXATION AND CROSS SECTION EFFECTS IN VALENCE BAND PHOTOEMISSION SPECTROSCOPY Ph.D. Thesis
Fenton Read McFeely Sep. 1976 182 p refs
(Contract W-7405-eng-48)
(LBL-5414) Avail: NTIS HC A09/MF A01

Various problems relating to the interpretation of valence band x-ray photoemission (XPS) spectra of solids are discussed. The experiments and calculations reported herein deal with the following questions: (1) To what extent do many-body effects manifest themselves in an XPS valence band spectrum and thus invalidate a direct comparison between the photoemission energy distribution, I(E), and the density of states, N(E), calculcated on the basis of ground-state one-electron theory (2) The effect of the binding-energy-dependent photoemission cross section on I(E) at XPS energies (3) In favorable cases indicated by (1) and (2), the effect is examined of the interaction of the crystal field with the apparent spin-orbit splittings of core levels observed in XPS spectra. (4) The use of tight binding band structure calculations to parameterize the electronic band structure from XPS and other data is described. (5) The use of high energy angle-resolved photoemission on oriented single crystals to gain orbital symmetry information is discussed. (6) The evolution of the shape of the photoemission energy distribution (of polycrystalline Cu) as a function of photon energy from 50 less than or equal h less than or equal 175 is discussed. ERA

N77-24914# Johns Hopkins Univ., Baltimore, Md. Dept. of Chemistry.
MOLECULAR BEAM STUDIES WITH F(+) IONS
Walter S. Koski 1976 16 p refs Submitted for publication
(Contract E(11-1)-3283)
(COO-3283-21) Avail: NTIS HC A02/MF A01

F(+) ion beam studies using simple atomic or molecular targets are summarized. The charge transfer between F(+) and Ne, the reaction F(+) with molecular hydrogen and its stable isotopic variants, dynamics of the F(+) (D2,D)FD(+) reaction and some reactions of F(+) with methane as a function of projectile ion kinetic energy are covered and examined for the information that they give on reaction mechanism and internal energy of the product ion. ERA

N77-24915# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ELASTIC SCATTERING OF Li(+)ON He AND Ar, AND INELASTIC SCATTERING OF H(+) AND H2 AT LOW ENERGIES Ph.D. Thesis - Goettingen Univ., West Ger. [ELASTISCHE STREUUNG VON Li(+) AN He UND Ar UND INELASTISCHE STREUUNG VON H(+) AN H2 BEI NIEDRIGEN ENERGIEN]
Klaus Rudolph Jul. 1976 160 p refs In GERMAN
(MPIS-8/1976) Avail: NTIS HC A08/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 35,00

Measurements of elastic differential scattering cross sections of the atom-ion/atom systems Li(+) -He and Li(+) -Ar in the energy range from 1.5 to 2.55 eV are reported. Inelastic differential scattering cross sections were also measured for the system H(+) -H2 at centers of gravity energies of 3.7 eV and 7 eV, using the time of flight method. ESA

N77-24916# IRT Corp., San Diego, Calif.
LARGE-AREA ELECTRON-BEAM EXPERIMENTS Final Report, Sep. 1973 - Jul. 1975
Daniel C. Osborne, Ralph H. Stahl, and Thomas N. Delmer Oct. 1976 79 p
(Contracts DNA001-75-C-0071; DAAG39-74-C-0006)
(AD-A033766; INTEL-RT-8101-011; HDL-CR-76-006-1) Avail: NTIS HC A05/MF A01 CSCL 20/3

This report contains experimental and analytical descriptions of IEMP produced with electron beams. The basic objective of the work reported was to obtain experimental data on space-charge neutralization in cavities, to test the adequacy of the existing theoretical model. A portion of the analysis of experimental results is included. The general trends in the transmitted current, such as variation of the pulse shape with pressure, are described by computer simulation. GRA

N77-24917# Physics International Co., San Leandro, Calif.
A FARADAY CUP WITH MULTIPLE INTERNAL FILTERS AND A PRIMARY CURRENT MONITOR FOR CHARACTERIZING HIGH DOSE PULSED ELECTRON BEAMS Final Report
K. Childers and J. Shea Oct. 1976 77 p refs
(Contract F29601-75-C-0123; DNA Proj. NWED-QAXAA121)
(AD-A034613; PIFR-835; AFWL-TR-76-132) Avail: NTIS HC A05/MF A01 CSCL 20/7

A Faraday cup with multiple internal filters has been developed for characterizing intense pulsed electron beams. Four points on the charge deposition profile can be obtained on a single pulse. These data, in conjunction with the diode voltage history and Monte Carlo electron transport calculations, can be used to establish the average transverse beam energy (mean angle of incidence) and hence the energy deposition profile. Performance of the device was demonstrated for a 5kJ, 600keV beam that was transported from the diode using longitudinal magnetic fields and that produced peak doses in excess of 200 cal/gm. A

primary current monitor was also developed. This thin foil device, which is inserted between the diode and a target, measures the transported primary beam current passing through the foils, but not the low energy beam plasma return current. The present design caused attenuation on the order of one-third of the beam energy. Three beam conditions obtained on the Model 225W Pulserad were characterized using these devices. The data confirm the absence of electron albedo in magnetically transported beams. Data obtained to investigate the effects of apertures on beam behavior indicate that apertures of 0.5-inch diameter or less lead to current waveforms that differ from the total current. GRA

N77-24918# Stanford Research Inst., Menlo Park, Calif.
INELASTIC COLLISIONS OF EXCITED ATOMS Annual Report, 1 Jul. 1975 - 30 Sep. 1976
Keith T. Gillen, Thomas M. Miller, and James R. Peterson 30 Nov. 1976 84 p refs
(Contract N00014-76-C-0118; SRI Proj. PYU-4529)
(AD-A033652; SRI-MP-76-105) Avail: NTIS HC A05/MF A01 CSCL 20/8

The interaction of metastable rare gas atoms with ground state atoms is being investigated in the energy range from several eV to 1 keV. Emphasis is on collisional ionization and collisional excitation transfer. Additional work examines details of the charge transfer reaction used to produce the fast metastable atom beams. GRA

N77-24919# Missouri Univ., Rolla.
PENNING IONIZATION: MEASUREMENT OF ION AND MOLECULAR LIFETIMES Annual Report, 1 Oct. 1975 - 1 Dec. 1976
R. A. Anderson and L. D. Schearer 1 Dec. 1976 37 p refs
(Contract N00014-75-C-0477; NR Proj. 343-011)
(AD-A033923; AR-10) Avail: NTIS HC A03/MF A01 CSCL 20/8

Contents: Radiative lifetimes and alignment depolarization cross sections for Yb(I) and (II) by the Hanle effect in a flowing helium system; Intense flowing hollow cathode lamp; The violation of the Franck-Condon principle in penning ionization; Radiative lifetime of the A squared delta state of CH; A high-power pulsed xenon ion laser as a pump source for a tunable dye laser; Radiative lifetimes of some group II ions by the Hanle effect in a fast-flowing helium afterglow; Rotational and predissociation lifetimes of the A squared sigma(+) state of OD; and Radiative lifetime of the B squared sigma(-) state of CH. GRA

N77-24920# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INTERACTION OF RELATIVISTIC PROTONS WITH MATTER M.S. Thesis
Gene P. Bendur Dec. 1976 160 p refs
(AD-A034948; GNE/PH/76D-1) Avail: NTIS HC A08/MF A01 CSCL 20/8

The mechanisms associated with the interaction of a relativistic proton beam with a target material are summarized, and a simple analytic calculation for each mechanism relates its importance in the deposition of energy. Because it was found that possible significant contributions could be related to collective effects, the first three moments of the Boltzmann-Vlasov equation and the equations necessary to describe the internal and external electromagnetic fields associated with the target are developed. These equations are then formulated into a computer program to describe the collective interaction process. Sample runs demonstrate the ability of the computer model to predict plasma oscillation at the proper frequency. Although an instability developed in the runs with the beam approaching the target, the preliminary analysis was accomplished, and the need for future detailed analysis of this process was established. Author (GRA)

N77-24921# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
EMISSION CROSS-SECTION MEASUREMENTS OF LOW ENERGY He(+) IONS WITH Cl2, Br2, I2 REACTIONS Ph.D. Thesis
Kenneth E. Siegenthaler Sep. 1976 303 p refs
(AD-A034035; DS/PH/76-2) Avail: NTIS HC A14/MF A01 CSCL 20/8

The cross sections for production of emission lines in the 60 nm to 870 nm region were measured for the collision of 100 eV He(+) ions with Cl2, Br2, and I2. These cross section measurements were made with an ion beam apparatus. Only emissions from transitions from excited electronic states with lifetimes shorter than a microsec were measured. The dependence of the cross sections on the kinetic energy of the He(+) ions between 2 to 170 eV was determined by use of the more intense emission lines. GRA

N77-24922# Arizona Univ., Tucson. Optical Sciences Center.
WATER MOLECULE MODELING TASK 2 OF INVESTIGATION OF GENERATION AND PROPAGATION OF INTENSE RADIATION Final Report
D. N. Rogovin and M. Sargent, III Dec. 1976 27 p refs
(Contract F29601-74-A-0023-0002)
(AD-A034533; AFWL-TR-75-132) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report summarizes and references work completed on the water molecule model. An overview of the work done is presented followed by information from papers published and abstracts of talks presented. Greater detail is also given on three-mode extensions and collision models. Author (GRA)

N77-24923# Princeton Univ., N. J. Dept. of Electrical Engineering.
MONTE CARLO STUDIES OF HOT-ELECTRON DISTRIBUTIONS IN THIN INSULATING FILMS. 2: ENERGY DEPENDENT MEAN FREE PATH AND INSTABILITY Special Technical Report no. 1
S. Baidyaroy, M. A. Lampert, B. Zee, and Ramon U. Martinelli (RCA Labs., Princeton, N.J.) 15 Nov. 1976 25 p refs
(Contracts DAAG53-76-C-0059; F19628-72-C-0298; ARPA Order 2182)
(AD-A034070; NVL-0059-002) Avail: NTIS HC A02/MF A01 CSCL 20/12

A Monte Carlo study has been made of hot electron energy distributions in thin insulating films. Whereas a constant energy-independent mean free path results in a stable energy distribution, it is shown that an energy-dependent mean free path which increases with increasing energy can lead to energetic runaway of the electrons. A graphical method has been developed to gain insight into this problem, and is illustrated by several prototypical examples. Author (GRA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N77-24924*# California Univ., Berkeley. Inst. of Governmental Studies.
SPACE DISPOSAL OF NUCLEAR WASTES. VOLUME 1: SOCIO-POLITICAL ASPECTS
T. LaPorte, G. I. Rochlin, D. Metlay, and P. Windham Dec. 1976 252 p refs
(Grants NsG-2160; NCA-2-OR-050-603)
(NASA-CR-153219) Avail: NTIS HC A12/MF A01 CSCL 18G

The history and interpretation of radioactive waste management in the U.S., criteria for choosing from various options for waste disposal, and the impact of nuclear power growth from 1975 to 2000 are discussed. Preconditions for the existence of high level wastes in a form suitable for space disposal are explored. The role of the NASA space shuttle program in the space disposal of nuclear wastes, and the impact on program management, resources and regulation are examined. Author

N77-24925# Addis Translations International, Portola Valley, Calif.
SOME ASPECTS OF HYBRID THERMONUCLEAR REACTORS

I. N. Golovin, G. E. Shatalov, and B. N. Kolbasov [1977] 16 p refs Transl. into ENGLISH from Izv. Akad Nauk SSSR: Energ. i Transp. (Moscow), no. 6, 1975 p 28-34 Sponsored by ERDA Prepared for Lawrence Livermore Lab.
(UCRL-Trans-11166) Avail: NTIS HC A02/MF A01

The main features of the thermonuclear reaction of the fusion of deuterium and tritium nuclei are pointed out from the standpoint of its use in power engineering. Possible variants for the commercial combination of thermonuclear and fission reactors are considered. The problems of tritium breeding and plutonium production in hybrid thermonuclear reactors are analyzed. A qualitative comparison is made between the economy of hybrid Tokamak reactors and that of conventional thermonuclear and fission reactors. The advisability of using subcritical hybrid reactors in the power industry and the fundamental difference between such reactors and units employing the electronuclear method of plutonium production are demonstrated. The technical and economic characteristics of helium- and lithium-cooled hybrid reactors are presented. ERA

N77-24926# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
SNAP-3D: A THREE-DIMENSIONAL NEUTRON DIFFUSION CODE
C. W. J. McCallien Oct. 1975 50 p refs
(TRG-Report-2677(R)) MF $0.65 from INIS Section, International Atomic Energy Agency, P. O. Box 590 A-1011, Vienna, Austria; also from HMSO £1.50

Data requirements of a one, two, or three dimensional multi group diffusion code, SNAP-3D, are described. This code is primarily intended for neutron diffusion calculations, but it can also carry out gamma calculations if the diffuse approximation is accurate enough. It is suitable for fast and thermal reactor core calculations and for shield calculations. The enhancements to SNAP that were made to produce the three dimensional version, SNAP-3D, were emphasized. ERA

N77-24927# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
A METHOD TO MEASURE NUCLEAR MOMENTA OF PROTONS ABOVE 250 MeV
G. Cirino 16 Jan. 1976 34 p refs In ITALIAN; ENGLISH summary Submitted for publication
(ISS-P-76/3) Avail: NTIS HC A03/MF A01

A method to measure the high momentum proton distribution on nuclei is proposed by studying gamma + p yields K(+) + lambda (0) reactions under the photoproduction threshold of hydrogen. The general set-up of experimental apparatus and several questions connected to the technique are discussed.
Author (ESA)

N77-24928# Singer Co., Little Falls, N.J. Kearfott Div.
NOISE SOURCES IN NMR OSCILLATORS AND RELAXATION PHENOMENA IN OPTICALLY PUMPED MERCURY ISOTOPES Final Scientific Report, Jun. 1972 - Jul. 1976
Donald S. Bayley, Ivan A. Greenwood, and James H. Simpson 31 Aug. 1976 115 p refs
(Contract F44620-72-C-0047; AF Proj. 9767)
(AD-A033737; KD76-31; AFOSR-76-1418TR) Avail: NTIS HC A06/MF A01 CSCL 20/8

Two investigations are described: the effects of noise in NMR oscillators, and spin relaxation of optically pumped Hg nuclei. A suitable noise model was provided by white-noise forcing of an NMR oscillator based on linearized Bloch equations. Experimental confirmation at the microhertz level was obtained. Measurements of Hg vapor density in one fused silica cell indicated the existence of three Hg-wall binding states. Excited Hg atoms were required to stimulate interstate transitions. Maximum spin-relaxation times for 199 Hg measured in glass and fused silica cells were, respectively, 40 and 11 min for 199 Hg and 50 and 100 sec for 201 Hg. In some fused silica cells evidence was found for a magnetic relaxation mechanism whose strength increased rapidly with temperature and may depend on the surface structure of the cell walls. By observing beats in free precession decay of 201 Hg electric quadrupole splittings as small as 1mHz were measured. Cell-intrinsic quadrupole splittings as large as 6.5mHz for fused silica and 17mHz for glass were observed. The cell-intrinsic splitting approached zero as the cell-axis-magnetic-field angle approached 55 deg. The relaxation rate on fused silica was enhanced after excited Hg atoms had been present in the cell. Author (GRA)

N77-24929# North Carolina State Univ., Raleigh. Dept. of Physics.
PRODUCTION, CONTROL AND UTILIZATION OF EXTREMELY HIGH DENSITY RELATIVISTIC STREAMS Final Report, 1 Jul. 1974 - 30 Jun. 1976
Willard H. Bennett 31 Aug. 1976 25 p refs
(Grant AF-AFOSR-2665-74; AF Proj. 9751)
(AD-A032908; AFOSR-76-1170TR) Avail: NTIS HC A02/MF A01 CSCL 20/7

A tapered form of diode has been used successfully to provide for delivery of the beam with reduced distance to the wall and resultant more effective delivery of material from the wall into the beam channel to aid in formation of the superpinched beam. Machine impedance characteristics need to be cleaned up in order to complete the investigation of the operation of the tapered tube. Author (GRA)

74 OPTICS

Includes light phenomena.

N77-24930 Polytechnic Inst. of New York.
TRANSVERSE EFFECTS ASSOCIATED WITH THE PROPAGATION OF COHERENT OPTICAL PULSES IN RESONANT ABSORBING MEDIA Ph.D. Thesis
Farres Phillip Mataar 1976 188 p
Avail: Univ. Microfilms Order No. 76-23430

A model using coupled scalar wave and the full Bloch's equations was developed to study the transverse reshaping that occurs when ultrashort optical pulses propagate through media resonant to the pulse carrier frequency. The origin and evolution of transverse energy flow and the conditions under which this energy flow leads to significant self-focusing are discussed. Numerical analysis of the coupled set of starting equations is presented in a set of universal curves constructed to summarize the dependence of the focusing of a self-induced transparency pulse on the system parameters. The physical mechanism responsible for the onset and development of the focusing phenomenon are discussed and related to other types of self-confinement of optical pulses. Dissert. Abstr.

N77-24931 California Univ., Berkeley.
THIN FILM PASSIVE AND ACTIVE DEVICES FOR INTEGRATED OPTICS Ph.D. Thesis
Won Tien Tsang 1976 315 p
Avail: Univ. Microfilms Order No. 77-4628

In the area of thin film passive optical devices, these include: optical waveguides that are capable of lateral optical confinement fabricated by using the etch-and-fill technique and utilizing preferential chemical etching; thin film beam splitters and reflectors for optical guided waves, thin film beam separators for multimode guided waves; and tapered edge ridge waveguides. Mode properties of such waveguides were studied. The same concept of lateral optical confinement can also be applied to laser structures. In fabricating the above heterostructure optical waveguides, the growth characteristics of GaAs-Ga1-xAlxAs heterostructure over preferentially etched channels by liquid phase epitaxy were also studied. In the area of thin film active optical devices, a structure for ring distributed feedback laser in the thin film form was proposed and analyzed. Dissert. Abstr.

N77-24932*# Scientific Translation Service, Santa Barbara, Calif.
HIGH POWER ZONE PLATES AS IMAGE-FORMING SYSTEMS FOR SOFT X-RAYS
G. Schmahl and D. Rudolph Washington NASA May 1977 14 p refs Transl. into ENGLISH from Optik (West Ger.), v. 29, no. 6, 1969 p 351-357
(Contract NASw-2791)
(NASA-TT-F-16776) Avail: NTIS HC A02/MF A01 CSCL 20F

A method is described to make zone plates with high zone numbers (N > or equal to 1,000) using laser interferences in

combination with photoresist layers. By focusing soft X-rays with such zone plates, spherical aberration occurs. This can be corrected if optics are used with special spherical aberration for producing the zone plates. Applications for high power zone plates (X-ray microscopes, X-ray telescope) are discussed. Author

N77-24933# Physics Lab. RVO-TNO, The Hague (Netherlands).
THEORY OF AEROSOL DETERMINATION BY MEANS OF LIDAR
G. J. L. Nooren Sep. 1976 47 p refs In DUTCH; ENGLISH summary
(PhL-1976-37; TDCK-68369) Avail: NTIS HC A03/MF A01

The feasibility of aerosol determination by means of a two color Mie-lidar was studied. The aerosols are important for determination of far infrared transmission. The scattering theory is outlined, aerosol properties are described, and the results of calculations for some aerosol models are given. The extinction of fogs does not seem to be strongly wavelength dependent. Experimental errors taken into account, only in some cases determination of aerosol particle size seems possible.
Author (ESA)

N77-24934# Physics Lab. RVO-TNO, The Hague (Netherlands).
REFLECTION COEFFICIENTS OF MILITARY VEHICLES AND CAMOUFLAGE NETS FOR VISIBLE AND NEAR INFRARED LIGHT AT 10.6 MICRON
W. J. P. A. Verbeek Sep. 1976 31 p refs
(PhL-1976-39; TDCK-68269) Avail: NTIS HC A03/MF A01

The reflectance properties of certain military vehicles, canvas rooftops and camouflage nets were studied in the 420-1150 nm (visible and near IR) region and at 10.6 micron (CO2 laser) for reconnaissance research purposes. Primary concern was to ascertain whether considerable difference existed between new and several years old material. This turned out not to be the case. Author (ESA)

N77-24935# Physics Lab. RVO-TNO, The Hague (Netherlands).
INFRARED SEA AND SKY BACKGROUND RADIATION
J. B. VandeVrie Nov. 1976 53 p refs
(PhL-1976-41; TDCK-68562) Avail: NTIS HC A04/MF A01

An investigation of sea and sky background radiance as a function of elevation in three wavelength intervals 3.0-5.0, 3.4-4.1 and 8.0-14.0 micron is described. A computer model, which has the lowtran 3 atmospheric transmission model as a subroutine, was developed to study the separate influence of a few meteorological parameters on these functions. The occurrence of a dip in the apparent temperature of the sea near the horizon has notably been analyzed. Results are summarized of the measurements of the background radiation around the horizon, made during a year by a scanning radiometer at an altitude of 30 meter above the sea surface. The radiance of the sky is measured and computed also for higher elevations (0-90 deg). Computations and measurements are in very good agreement except for the small interval 3.4-4.1 micron. The latter might be caused by an overestimation of the transmission by the lowtran 3 model in this wavelength band. Author (ESA)

N77-24936# Honeywell Corporate Research Center, Bloomington, Minn.
STRAIN INDUCED WAVEGUIDING IN OPTICAL MATERIALS FOR INTEGRATED OPTICS APPLICATION Final Report, 1 May 1975 - 30 Sep. 1976
D. Chen, B. Koepke, C. Knudson, and G. B. Hocker Dec. 1976 117 p refs
(Contract N00014-75-C-1097)
(AD-A034679; HR-47024) Avail: NTIS HC A06/MF A01 CSCL 20/6

Significant research results achieved under this investigation are: techniques for preparing laser heating strain-induced (LHSI) optical waveguides have been developed, and the properties of waveguides made with optical filter glass were obtained. A microprocessor-controlled LHSI optical waveguide circuit fabrication facility was constructed, and simple waveguide circuit elements were obtained. X-ray and optical measurement techniques were developed for the characterization of the photoelastic effect and the effect of optical polishing in selected integrated optic materials. Author (GRA)

N77-24937# Washington Univ., St. Louis, Mo. Lab. for Applied Electronic Sciences.
COUPLING OF SINGLE-MODE OPTICAL FIBERS TO GaAs WAVEGUIDES Semiannual Technical Report, 1 Aug. 1975 - 31 Jan. 1976
William S. C. Chang Griffiss AFB, N. Y. RADC Oct. 1976 46 p refs
(Contract F19628-76-C-0032; ARPA Order 3020)
(AD-A034609; RADC-TR-76-313; SATR-1) Avail: NTIS HC A03/MF A01 CSCL 20/6

An investigation was conducted to find an efficient method to couple a single-mode optical fiber to a GaAs waveguide at near infrared wave lengths. The general approach is to first fabricate a transitional waveguide. The fiber and the transitional waveguide are then coupled together by the tapered velocity coupling method. Step index transitional waveguide structures were fabricated and evaluated with a coupling efficiency of 77%, a value close to theoretical limit. Fabrication of silica fiber horn was not successful due to the thermal properties of the silica fiber materials. Alternative methods are being investigated to match the cylindrical geometry of the fiber to the planar geometry of the uniform waveguide, replacing the fiber horn. GRA

N77-24938# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
SOLID STATE OPTICAL DETECTOR Final Report, 1 Jun. 1971 - 30 Sep. 1974
R. W. Grow, J. R. Boye, C. K. Peterson, and R. W. Ure, Jr. 27 Aug. 1976 101 p refs
(Contract N00014-67-A-0325-0005)
(AD-A034173; UTEC-MD-76-233) Avail: NTIS HC A06/MF A01 CSCL 17/8

With the development of the laser and its enormous bandwidth capabilities, the simultaneous development of the photosensing devices has proceeded. A photodiode is one of these devices and shows great promise due to its inherent sensitivity, ruggedness, and the ability to obtain large internal gain. Because of this, many photodiodes have been built with responses into the microwave region. These devices have extremely small active areas and low quantum efficiencies, as with a point contact photodiode. This paper discusses the problems of building a large area high frequency photodiode and how they were overcome. The theoretical considerations for using a free-running inhomogeneously broadened laser to obtain a milli-frequency signal to test the photodiodes are discussed in some detail. These results have been used to obtain the frequency response of the photodiodes. GRA

N77-24939# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF AN OPTICAL DISC RECORDER Quarterly Technical Report, 1 Jul. - 30 Sep. 1976
George Kenney, F. Zernike, D. Lou, M. Goutmann, and A. Milch Nov. 1976 98 p refs
(Contract N00014-76-C-0441; ARPA Order 3080)
(AD-A034128; PL-52-VR-1124) Avail: NTIS HC A05/MF A01 CSCL 14/3

The recorder was modified for limited operation at 3 rps. Refitting the new optical and digital subsystems into a deliverable system is now planned on a back-up sled and turntable. PMMA discs coated with tellurium films were recorded on through the backside of the disc surface. Air sandwich fabrication is showing good progress. First results of an accelerated life testing program indicate that tellurium films do not degrade at high temperatures. An initial recommendation for digital formatting, coding, and error correction techniques is given. A theoretical analysis of expected hole machining characteristics for a moving substrate was performed. Author (GRA)

N77-24940# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTICS RESEARCH, 1976, 1 Semiannual Technical Summary Report, 1 Jan. - 30 Jun. 1976
Robert H. Rediker 30 Jun. 1976 23 p refs
(Contract F19628-76-C-0002; ARPA Order 600)
(AD-A034583; ESD-TR-76-220) Avail: NTIS HC A02/MF A01 CSCL 20/5

Contents: Laser Technology and Propagation--Laser Effects - Effect of Pulse Shape and Pulse Length on Enhanced Thermal Coupling to Metals, Long-Pulse HF Laser Breakdown Experiment;

Stable CO2 Laser Development and Evaluation - Calibration of C(14)O2(16) Laser Lines; Pollution Studies. GRA

N77-24941# BALA, Fairport, N. Y.
EXPERIMENTAL HETERODYNE OPTICAL CORRELATOR Final Report
N. Balasubramanian Oct. 1976 91 p refs
(Contract DAAG53-76-C-0009)
(AD-A033393; ETL-0071) Avail: NTIS HC A05/MF A01 CSCL 08/2

Over the last several years considerable progress has been made both with regard to the demonstration of the basic concepts of heterodyne optical correlation (HOC) systems as well as the evaluation of the potentials of such a system to achieve automation of the stereocompilation process. This document is the final technical report on a detailed study to test, analyze and achieve optimization of the experimental HOC system design. The heterodyne optical correlation system is a generalized optical correlation system having significant advantages in its application to stereocompilation. The detection of the regions of conjugate image coincidence between two transparencies through image correlation forms the basis for most automated stereocompilation systems. In the HOC system the two transparencies forming the stereopair are relatively oriented and projected onto a common image plane where coincidence is detected. By means of heterodyne optical techniques a normalized correlation coefficient is measured at each element of a photodiode array in the common image plane. The normalized correlation values are then used to define regions of conjugate image coincidence for a given orientation between transparencies. GRA

N77-24942# Kansas State Univ., Manhattan. Dept. of Physics.
THE OPTICAL CONSTANTS OF WATER AND SEA WATER IN THE INFRARED
Dudley Williams 20 Dec. 1976 18 p refs
(Contract N00014-76-C-0252)
(AD-A034071; SR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

The results of earlier studies of reflection and absorption in various spectral regions are reviewed and then used to provide values of the complex index of refraction N = n + ik of water at 27 C in the spectral range 1/5000-10 cm, corresponding to wavelengths in the range 2 micrometer to 1 mm. Optical Properties of Sea Water in the Infrared: Quantitative measurements of the ratio of the infrared spectral reflectance of standard sea water at near-normal incidence to the corresponding spectral reflectance of pure water at 27 C were made. The infrared spectral reflectance of standard sea water was determined from the measured ratio and the known optical constants for pure water. The real n(v) and the imaginary k(v) parts of the complex index of refraction of standard sea water were then determined by KramerKronig methods. The results obtained for the standard sea water are compared with previous results obtained for pure water and with previous studies of sea water. GRA

N77-24943# Pennsylvania State Univ., University Park. Applied Research Lab.
QUANTITATIVE SCHLIEREN VISUALIZATION Ph.D. Thesis
Steve Stanic 1 Oct. 1976 111 p refs
(AD-A034451; TM-76-279) Avail: NTIS HC A06/MF A01 CSCL 20/1

A method to obtain quantitative information directly from a schlieren image is investigated. Using the exact timed format of the video signal, the television raster is vertically scanned at a predetermined position and a sample point taken on each of the 525 horizontal lines. Using digital techniques, voltage displays corresponding to the black-white scene information are presented on an oscilloscope and plotted on an X-Y recorder. A single calibration curve gives relative sound pressure measurements. The results are compared for high frequency transmission and reflection from a thick steel plate. In addition, optimum optical arrangements and source configurations are discussed.
Author (GRA)

N77-24944# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
STUDY OF WATER VAPOR ABSORPTION LINES IN THE NEAR INFRARED Final Report, 1 May 1973 - 30 Jun. 1975
Ali Javan 30 Nov. 1976 40 p refs
(Contract N00014-75-C-0360; ARPA Order 1807)
(AD-A034440) Avail: NTIS HC A02/MF A01 CSCL 07/4

The purpose of this work was to develop a highly stable spin flip Raman laser that could be tuned through the 5 micron region in order to study water vapor absorption lines. The pressure broadening coefficients for various buffer gases when added to water was measured with this system. A general technique was devised to measure the shape of absorption lines well out onto the wings to determine if there were any deviation from a Lorentzian lineshape. In addition, theoretical work was done on the interaction of a radiation field with molecules undergoing a collision. A formulation was developed and used to treat the case of a collision between two noble gases. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-24945*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEUTRON MONITORING AND ELECTRODE CALORIMETRY EXPERIMENTS IN THE HIP-1 HOT ION PLASMA
John J. Reinmann and Robert W. Layman (Dartmouth Coll.) May 1977 27 p refs Presented at Am. Phys. Soc. Meeting, San Francisco, 15-19 Nov. 1976
(NASA-TM-X-3525; E-9063) Avail: NTIS HC A03/MF A01 CSCL 20I

Results are presented for two diagnostic procedures on HIP-1: neutron diagnostics to determine where neutrons originated within the plasma discharge chamber and electrode calorimetry to measure the steady-state power absorbed by the two anodes and cathodes. Results are also reported for a hot-ion plasma formed with a continuous-cathode rod, one that spans the full length of the test section, in place of the two hollow cathodes. The outboard neutron source strength increased relative to that at the midplane when (1) the cathode tips were moved farther outboard, (2) the anode diameters were increased, and (3) one of the anodes was removed. The distribution of neutron sources within the plasma discharge chamber was insensitive to the division of current between the two cathodes. For the continuous cathode, increasing the discharge current increased the midplane neutron source strength relative to the outboard source strength. Each cathode absorbed from 12 to 15 percent of the input power regardless of the division of current between the cathodes. The anodes absorbed from 20 to 40 percent of the input power. The division of power absorption between the anodes varied with plasma operating conditions and electrode placement.
Author

N77-24946# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN STUDY OF ELECTROSTATICALLY PLUGGED CUSP FUSION REACTOR
T. J. Dolan 1 Nov. 1976 74 p refs
(Contract W-7405-eng-48)
(UCRL-52142) Avail: NTIS HC A04/MF A01

This study concentrates on the following aspects of an electrostatically plugged cusp reactor that will be different from other fusion reactor designs: the coil geometry and structural supports, high voltage electrodes, plasma parameters, power balance, and operating cycle. Assuming the electron density distribution in the anodes to have a characteristic width of two electron Larmor radii, which is consistent with present experimental results, the theory predicts that a device with a magnetic field strength, B = 8 T sustained solely by electron beam injection at 300 kV will have a power gain ratio, Q, of about 5. A toroidal multipole cusp configuration with six cusps was selected for the present design, based on a study of the ratio of plasma volume to coil volume. Coil forces are sustained by cryogenic trusses between like coils, fiberglass compression columns, and

room temperature hoops. Radiation collimators in front of the high voltage electrodes greatly reduce the radiation impinging on the cathodes, helping to avoid breakdown and to prolong insulator life. The operating cycle consists of a startup period of about 20 s, followed by a fusion burn period lasting about 200 s (limited by impurity buildup) and a 20-s flushing period. ERA

N77-24947# Los Alamos Scientific Lab., N. Mex.
PROFILE STUDY OF SHEAR STABILIZATION OF THE LOWER HYBRID DRIFT INSTABILITY IN THE REVERSE-FIELD SCREW PINCH
R. Gerwin Oct. 1976 15 p refs
(Contract W-7405-eng-36)
(LA-6552) Avail: NTIS HC A02/MF A01

A criterion due to N. Krall for magnetic shear stabilization of the Lower-Hybrid Drift Instability is applied to model profiles of the Reverse-Field Screw Pinch configuration. Conditions that can virtually eliminate this instability are found numerically, for gentle density profiles. However, shear-stabilization proves to be ineffective for sharper (but still reasonable-looking) profiles. If such profiles have to be lived with, it becomes necessary to rely either on finite-beta stabilization or on the fact that this instability possesses a threshold related to ion gyro-resonance. ERA

N77-24948# Oak Ridge National Lab., Tenn.
PLASMA ENGINEERING IN A DEUTERIUM-TRITIUM FUELED TOKAMAK
D. G. McAlees, ed. and F. B. Marcus, ed. Oct. 1976 136 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5573) Avail: NTIS HC A07/MF A01

Plasma Engineering includes both basic investigations and the application of research results to fusion system design. Plasma Engineering provides fusion physics input to various CTR programs so that the effects of system operating limitations and requirements can be considered in the design process. A broad scope of Plasma Engineering information is presented. For example, Tokamak dimensions and scaling, magnetic field requirements, impurity control and wall material criteria, poloidal field system design, effects of changing the number and shape of the toroidal field coils, plasma ionization and breakdown, fueling, plasma heating by neutral beam injection, vacuum requirements and components, low-neutron-yield testing and prospects for clean fuels are discussed. The analyses and techniques developed are specifically applied to the Oak Ridge Experimental Power Reactor (EPR). ERA

N77-24949# Princeton Univ., N. J. Plasma Physics Lab.
LOWER HYBRID PARAMETRIC INSTABILITIES: SATURATION BY CASCADING AND PUMP DEPLETION
R. L. Berger, L. Chen, and F. W. Perkins Nov. 1976 59 p refs
(Contract E(11-1)-3073)
(PPPL-1307) Avail: NTIS HC A04/MF A01

Parametric instabilities near the lower hybrid frequency and associated electron and ion heating were observed experimentally for some years, most recently in radio-frequency heating experiments on the Adiabatic Toroidal Compressor Tokamak. The nonlinear evolution and saturation by cascading of the parametric decay instability near the lower-hybrid frequency is considered by solving a weak-turbulence wave kinetic equation. The principal results are that: (1) a steady state solution exists only for pumps near threshold when the pump frequency is several times the lower hybrid frequency; (2) the decay instability saturates when the energy in decay waves is roughly equal to the pump energy; (3) most of the pump energy is deposited in super thermal electrons when omega X is much greater than omega sub 1h and (4) pump depletion in the low-density surface plasma will be a serious problem unless the pump power is kept near threshold for large Tokamaks. ERA

N77-24950# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
AN EXPLANATION OF THE APPARENT CONTRADICTION BETWEEN THE SUYDAM AND CLOSED-LINE STABILITY CRITERIA
Torbjoern Hellsten Jan. 1977 31 p refs Sponsored in part by EURATOM
(TRITA-EPP-77-05) Avail: NTIS HC A03/MF A01

The discrepancy between the Suydam criterion in the limit of low shear and the closed-line criteria is discussed. The unstable spectrum was investigated for a straight hard-core pinch surrounded by conducting walls. As the shear decreases, the unstable spectrum moves to higher axial wave numbers. It is likely that these modes can be stabilized by finite Larmor radius effects in the limit of low shear. Stable equilibria should then exist with a descreasing pressure in absence of an axial magnetic field. Author (ESA)

N77-24951# Naval Research Lab., Washington, D. C.
HIGH ENERGY ION ANALYZER FOR LASER-PRODUCED PLASMA STUDIES
R. Decoste and B. H. Ripin Nov. 1976 17 p refs
(NRL Proj. H02-29A)
(AD-A034737; NRL-MR-3365) Avail: NTIS HC A02/MF A01 CSCL 20/9

A simple electrostatic deflection multi-channel time-of-flight ion analyzer optimized to study high energy ion species from laser-produced plasmas is described. For this application moderate species and energy resolution over a wide dynamic energy range is desirable. A dynamic energy range from 1 to 1000 keV per unit charge is achieved with a 20 kV power supply. Design considerations are presented together with some typical experimental results. GRA

N77-24952# Naval Research Lab., Washington, D. C.
DIAGNOSTICS FOR INTENSE PULSED ION BEAMS
F. C. Young, J. Golden, and C. A. Kapetanakos Oct. 1976 64 p refs
(NRL Proj. H02-28A)
(AD-A033691; NRL-MR-3391) Avail: NTIS HC A04/MF A01 CSCL 20/9

Diagnostic methods and techniques for intense pulsed ion beams are presented. Especially important is a detailed description of the measurement of delayed radioactivity from nuclear reactions induced in a target by the ions. This activation analysis provides the most precise, unambiguous means of determining the number of ions per pulse that is presently available. A compilation of yields and cross sections for several nuclear reactions is given. Included among the nuclear techniques is the measurement of prompt radiation such as gamma-rays and neutrons from ion induced reactions. In addition a scintillator-photodiode detector is described which has been proven to be useful for the measurement of time-of-flight and which may be used to observe the relative pulse shape. Biased ion collectors and difficulties associated with their use are also discussed. GRA

N77-24953# Naval Research Lab., Washington, D. C. Plasma Dynamics Branch.
THE INITIAL BEHAVIOR OF PLASMONS IN THE PRESENCE OF A LONG WAVELENGTH LARGE AMPLITUDE PHONON Interim Report
W. E. Hobbs, Jr. and W. M. Manheimer Nov. 1976 17 p refs
(AD-A033915; NRL-MR-3406) Avail: NTIS HC A02/MF A01 CSCL 20/9

Using a one dimensional two-fluid model, the behavior of electrostatic electron plasma oscillations in the presence of a large amplitude long wavelength ion acoustic wave has been studied. The electron waves are observed to collect initially in regions of maximum density gradients. The initial increase in the variance of the plasma on wave numbers is quadratic in time. When the high frequency fields are characterized by a narrow spectrum in k-space, a solution of the fluid equations is obtained which exhibits these results. Author (GRA)

N77-24954# Illinois Univ., Urbana-Champaign. Dept. of Electrical Engineering.
RESEARCH IN INFRARED AND OPTICAL QUANTUM ELECTRONICS. A: INFRARED SENSITIVITY, OF PLASMAS. B: PICOSECOND DYNAMICS OF SURFACE PHOTOELECTRONS Final Report
Henry Merkelo May 1976 168 p refs
(Contract N00014-67-A-0305-0017)

(AD-A033947; UILU-ENG-76-2548) Avail: NTIS HC A08/MF A01 CSCL 20/10

Upon discovery of the infrared sensitivity of weakly ionized plasmas, research was initiated at establishing the quantum origins of the observed interactions. Taking into account the obvious inverse bremsstrahlung process, studies were made to evaluate the role of bound-bound and bound-free transitions under the influence of low energy photon flux corresponding to the intermediate and far-infrared portions of the spectrum. It was established and documented that in a broad range of electron temperatures and densities of weakly ionized plasmas, the bound-free transitions induced by infrared photons affect the recombination process to a significant and, frequently, to a dominant degree. Theoretical results are obtained on the basis of a hydrogenic model. Experiments demonstrate the generality of the infrared sensitivity of plasmas. A separate phase of research in optical quantum electronics dealt with optical interaction with surface and near surface electrons in photoemissive materials. In particular, the dynamics on picosecond time scales of electrons released from the surface and near-surface of select materials is of both fundamental and practical interest. Negative electron affinity materials, known for their high quantum efficiency, are predicted to exhibit maximum time dispersion of a step excitation. Preliminary studies and the development of tools needed for an experimental determination of parameters on picosecond time scales, were the principal goals of this effort. As a byproduct, a patent was filed and granted on the more successful configurations of devices designed to carry out the basic surface emission studies. GRA

N77-24955# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

PLASMA BOUNDARIES IN SPACE Interim Report

Michael Schulz 9 Nov. 1976 21 p refs

(Contract F04701-76-C-0077)

(AD-A033996; SAMSO-TR-76-220; TR-0077(2260-20)-3) Avail: NTIS HC A02/MF A01 CSCL 20/9

This work is primarily a survey and review of recent theoretical progress in the identification and characterization of plasma boundaries in space. The specification of such boundaries is an essential step in the formulation of self-consistent Vlasov equilibria, which is (in turn) prerequisite to an analysis of the stability of plasma boundaries against small perturbations. Topics discussed include the following: magnetopause; bow shock and heliopause; interplanetary sector boundary; planetary neutral sheet; plasmapause; convection on open field lines. GRA

N77-24956# Wisconsin Univ., Madison. Mathematics Research Center.

SELF SIMILAR SOLUTION OF PLASMA EQUATIONS

K. E. Lonngren Nov. 1976 30 p refs Presented at NFS Sponsored Workshop on Plasma Phys., Ahmedabad, India, 29 Nov. - 1 Dec. 1976

(Contract DAAG29-75-C-0024; Grant NSF ENG-76-15645)

(AD-A034467; MRC-TSR-1698) Avail: NTIS HC A03/MF A01 CSCL 05/9

This paper describes the method of self similar solution of partial differential equations and reviews its application to several problems found in plasma physics. GRA

N77-24957# Michigan Univ., Ann Arbor. Dept. of Mathematics.

MAGNETOHYDRODYNAMICS, PLASMAS, AND NONLINEAR OSCILLATIONS Final Report

Lamberto Cesari Oct. 1976 10 p

(Grant AF-AFOSR-2122-71)

(AD-A033106; AFOSR-76-1172TR) Avail: NTIS HC A02/MF A01 CSCL 20/9

During this period, the nine scientists associated with the project produced 76 papers of which 35 have appeared in journals at this time. Many invited lectures, editorships and a chair in mathematics attest to the ability of the principal investigators. In the area of entrainment of frequency in the large involving oscillations of physical systems at resonance and across point of resonance 14 papers were produced. Pareto optimization theorems in optimal control theory account for three papers. Six papers on optical resonance of laser beams in crystals and 11 papers on evolution equations and related problems in shock wave theory, semiconductors, diffusion, combustion kinetics and ecological systems give an idea of the diversity of areas addressed by the functional analytic techniques of Professors Ceasari, Smoller Suryanarayana, Kannan and associates. Author (GRA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N77-24958 Massachusetts Univ., Amherst.

MAGNETIC PROPERTIES OF ITINERANT FERROMAGNETS AT LOW TEMPERATURES Ph.D. Thesis

Jai-Ching Wang 1976 82 p

Avail: Univ. Microfilms Order No. 77-6465

Green's function techniques were used to study the effects of correlations on the magnetic properties of itinerant ferromagnets at low temperatures. In an itinerant ferromagnet, the coupling between the up and down spin electron states via spin waves leads to a mixing of these states. These mixed single particle states were used to calculate the dynamic susceptibility. The susceptibility was found to have four continuum bands. Two started at zero energy for zero momentum, the paramagnetic-like bands; the other two bands were the usual Stoner bands. The spin waves were completely damped by these paramagnetic-like bands contrary to the experimental results. This suggests taking into account further correlation as represented in field theory by the vertex corrections. Taking these further correlations into account, the paramagnetic-like bands are eliminated, the spin waves are well defined, and the electron spin splitting persist at low temperatures as expected. Dissert. Abstr.

N77-24959# Communications Research Centre, Ottawa (Ontario). Space Technology Branch.

GALLIUM ARSENIDE MATERIALS AND DEVICES AND THE GUNN EFFECT

W. D. Edwards, W. A. Hartman, A. B. Torrens, and D. L. Butler Dec. 1976 132 p refs

(CRC-1303) Avail: NTIS HC A07/MF A01

Gallium arsenide, NDC effects, and their applications to microwave devices are briefly reviewed. Material processing, vapor epitaxial growth, contacts, diode fabrication, and computer simulation of diodes are also considered. Author

N77-24960# Oak Ridge National Lab., Tenn.

SPECTRAL DENSITY FUNCTIONS FOR DISORDERED SYSTEMS Ph.D. Thesis - Tenn. Univ.

Dennis Gene Hall Nov. 1976 91 p refs

(Contract W-7405-eng-26)

(ORNL-5184) Avail: NTIS HC A05/MF A01

A Monte Carlo calculation of the spectral density function A(k,E) is described for a one-dimensional model of an amorphous solid. The model contains an adjustable short-range order parameter and A(k,E) is obtained for several values of that parameter. The Hamiltonians considered are: (1) the Hamiltonian describing an electron moving in a potential consisting of randomly placed delta functions, (2) the Hamiltonian describing a system of coupled harmonic oscillators, and (3) a tight-binding Hamiltonian describing in a simplified way either electrons or spin-waves. The spectral density A(k,E) gives the single-particle contribution to the dynamic form factor of neutron scattering theory. In another application of the model calculation, the spectral density is obtained in the quasicrystalline approximation (QCA) for the problem of an electron in a one-dimensional liquid metal. The QCA and exact spectra densities are compared and it is shown that the QCA fails in the strong scattering regime. ERA

N77-24961# California Univ., Livermore. Lawrence Livermore Lab.

HELIUM GENERATION AND DIFFUSION IN GRAPHITE AND SOME CARBIDES

J. B. Holt, M. W. Guinan, D. W. Hosmer, R. H. Condit, and R. J. Borg 17 Sep. 1976 10 p refs Presented at 2d Topical Meeting on the Technol. of Controlled Nucl. Fusion, Richland, Wash., 21 Sep. 1976

(Contract W-7405-eng-48)
(UCRL-78062; Conf-760935-28) Avail: NTIS HC A02/MF A01

The cross section for the generation of helium in neutron irradiated carbon was found to be 654 mb at 14.4 MeV and 744 mb at 14.9 MeV. Extrapolating to 14.1 MeV (the fusion reactor spectrum) gives 615 mb. The diffusion of helium in dense polycrystalline graphite and in pyrographite was measured. It is assumed that diffusion is primarily in the basal plane direction in crystals of the graphite. In polycrystalline graphite, the path length is a factor of square root of 2 longer than the measured distance due to the random orientation mismatch between successive grains. Isochronal anneals were run and maximum release rates were found at 200 C in polycrystalline graphite, 1000 C in pyrographite, 1350 C in boron carbide, and 1350 and 2400 C (two peaks) in silicon carbide. It is concluded that in these candidates for curtain materials in fusion reactors the helium releases can probably occur without bubble formation in graphites, may occur in boron carbide, but will probably cause bubble formation in silicon carbide. ERA

N77-24962# California Univ., Berkeley. Lawrence Berkeley Lab.
METASTABILITY AND CRYSTALLIZATION STUDIES IN THE SILICA-ALUMINA SYSTEM Ph.D. Thesis
S. H. Risbud Aug. 1976 130 p refs
(Contract W-7405-eng-48)
(LBL-5453) Avail: NTIS HC A07/MF A01

Activities, activity coefficients, and free energies of mixing in SiO1-Al2O3 solutions were calculated from the phase diagram using regular solution approximations and used to estimate regions of liquid-liquid immiscibility. A metastable liquid miscibility gap with a consolute temperature of 1540 C at 36 mole percent Al2O3 was calculated; the gap extended from 6.25 to 57 mole percent Al2O3 at 800 C. Glass-in-glass immiscibility occurred between 7.5 and 20 mole percent Al2O3 but compositions greater than 25 mole percent Al2O3 crystallized very rapidly. Marked positive deviations from ideal mixing suggest a tendency for liquid immiscibility in both SiO2-rich and Al2O3-rich compositions. A metastable SiO2-Al2O3 phase diagram in the absence of mullite obtained by extensions of the SiO2 and Al2O3 liquid to lower temperatures was proposed to account for formation of glassy phases in subsolidus cristobalite-corundum reactions. ERA

N77-24963# Los Alamos Scientific Lab., N. Mex.
Fe-57 IMPURITY ATOM LATTICE DYNAMICS AND SYSTEMATICS IN GROUP V AND VI HOST METALS
R. D. Taylor, T. A. Kitchens, Jr., and D. J. Erickson 1976 20 p refs Presented at Intern. Conf. on the Appl. of the Mossbauer Effect, Corfu, Greece, 13 Sep. 1976
(Contract W-7405-eng-36)
(LA-UR-76-2065; Conf-760938-1) Avail: NTIS HC A02/MF A01

The Mossbauer recoil-free fraction f and thermal shift were measured for very dilute Fe-57 impurities in body-centered cubic V, Nb, Mo, Ta, and W host metals in the range 4 to 860 K. These experimental quantities were interpreted in terms of an impurity-atom lattice-dynamical model of Mannheim where the important parameter gamma/sub ih//gamma/sub hh/is a measure of the coupling of the impurity atom to the host lattice relative to the corresponding coupling in the pure host lattice. Values of gamma/sub ih//gamma/sub hh/ for each host were obtained from the f-value and from the shift data. The general trend of the data shows that for neighboring hosts of the same row of the periodic table, the relative Fe.57 impurity binding is stronger for the Group V host than for the Group VI host. The results indicate that the nearest-neighbor binding between the impurity and the host should be proportional to a geometric mean of the nearest-neighbor couplings for a lattice consisting entirely of impurity atoms and for a lattice of host atoms only. ERA

N77-24964# Montpellier Univ. (France). Dept. de Physique Mathematique.
HOW TO PRODUCE AND OBSERVE THE 1P1 CHARMONIUM STATE
F. M. Renard Sep. 1976 9 p refs
(PM/76/9) Avail: NTIS HC A02/MF A01

The possible decay modes and production mechanisms of the 1P1 charmonium state are discussed. ESA

N77-24965# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
CRYOGENIC EQUIPMENT FOR SUPERCONDUCTIVITY MEASUREMENTS DOWN TO 1.5 K IN THE MICROWAVE RANGE
M. Flamini, S. Onori, A. Rosati, and P. Tonna 7 Jan. 1976 37 p refs In ITALIAN; ENGLISH summary
(ISS-T-76/2) Avail: NTIS HC A03/MF A01

A cryogenic method to perform microwave measurements in the temperature range at liquid helium both for EPR and superconductivity measurements, is described. The system can work in the range 1.5 to 300 K, and control the temperature well within 0.001 K. Technical solutions adopted for temperature control in the range from 1.5 to 4.2 K and from 4.2 to 300 K are described. Author (ESA)

N77-24966# Wisconsin Univ., Madison. Materials Science Center.
TRANSITION DENSITY OF STATES FOR Si(100) FROM Li L23V AND L23VV AUGER SPECTRA
J. E. Houston, B. Moore, and M. G. Lagally 26 Dec. 1976 14 p refs
(Contract N00014-76-C-0727)
(AD-A034650) Avail: NTIS HC A02/MF A01 CSCL 20/8

The L123V and L23VV Auger spectra of sputtered and annealed Si (100) have been measured and the transition density of states extracted. The line shapes for the two transitions differ, indicating the importance of matrix element effects. Whereas the L1 L23(V) line shape closely resembles results of other measurements of the Si density of states, the L23VV line shows a strong emphasis on p-like states. GRA

N77-24967# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Technical Summary Report, 1 May - 31 Jul. 1976
Alan L. McWhorter 15 Aug. 1976 73 p refs Sponsored in part by ERDA, ARPA, U.S. Army, and NSF
(Contract F19628-76-C-0002; AF Proj. 649L)
(AD-A034647; ESD-TR-76-226) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 May through 31 July 1976. The topics covered are solid state device research, quantum electronics, materials research, microelectronics, and surface-wave technology. Author (GRA)

N77-24968# Naval Academy, Annapolis, Md.
LOW FREQUENCY DIELECTRIC PROPERTIES OF WIDE BAND-GAP SEMICONDUCTORS
Scott M. Jenkins 17 Mar. 1976 196 p refs
(AD-A032715; USNA-TSPR-77) Avail: NTIS HC A09/MF A01 CSCL 20/12

The complex dielectric constant has been measured for single crystal CdS and CdSe, and amorphous As2S3, As2Se3, and ZnSe at five audio frequencies 1000-10000 Hz over the temperature range 4.2-300 K at 1 atmosphere and over the pressure range 1-3000 atmospheres at temperatures from 260-320 K. Anomalies are noted in the temperature variation of the real part of the dielectric constant for the As glasses. One anomaly is attributable to a Debye-type impurity while the other remains unexplained. The volume independent temperature derivative and temperature independent volume derivative of the real part of the dielectric constant are calculated for each material. These are used in conjunction with the Clausius-Mossotti equation to evaluate the various contributions to the pressure and temperature derivatives of the dielectric constant. For CdS, the Lyddane-Sachs-Teller relation is found to hold and the Szigeti effective charge is calculated. Finally, the possible use of these materials as a pressure transducer is discussed. Author (GRA)

N77-24969# Naval Research Lab., Washington, D. C.
TOKAMAK PLASMA HEATING WITH INTENSE PULSED ION BEAMS
Edward Ott and Wallace M. Manheimer Oct. 1976 37 p refs

(AD-A032813; NRL-MR-3394) Avail: NTIS HC A03/MF A01 CSCL 20/9

The recent availability of intense, space-charge-neutralized, energetic ion beams has led us to explore the possibility of using them for heating Tokamak plasmas. The following key problems for this application are investigated: (1) beam injection perpendicular to B, (2) beam propagation across B in vacuum, and (3) cross-field beam propagation and energy deposition in plasma. It appears possible that, for proper values of the beam energy, radius and current, an intense ion beam can penetrate to the interior of a Tokamak plasma and deposit its energy there. Author (GRA)

N77-24970# Office of Naval Research, London (England).
THE 8TH INTERNATIONAL SYMPOSIUM ON THE REACTIVITY OF SOLIDS
P. J. Herley (State Univ. of New York, Stony Brook) 23 Sep. 1976 14 p Symp. held at Gothenburg, Sweden, 14-19 Jun. 1976
(AD-A033334; ONRL-C-27-76) Avail: NTIS HC A03/MF A01 CSCL 20/12

The Eighth International Symposium on the Reactivity of Solids was held at Chalmers University of Technology, Gothenburg, Sweden 14-19 June 1976. The conference focused on six major aspects of the reactivity of solids: reaction at surfaces and interfaces, especially at elevated temperatures; the influence of structural defects on reactivity; solid state reactions in organic materials; reactions in vitreous solids; new experimental methods for studying reactivity in solids; the role of solid state reactions in materials technology. GRA

N77-24971# Minnesota Univ., Minneapolis. Inst. of Tech.
EXPERIMENTAL STUDIES IN SOLID STATE AND LOW TEMPERATURE PHYSICS Final Report
Nov. 1976 23 p refs
(Contracts N00014-71-C-0235; E(11-1)-1569)
(AD-A034161) Avail: NTIS HC A02/MF A01 CSCL 20/13

Experimental investigations are being carried out in a broad area of low-temperature and solid-state physics which includes superconductivity, magnetism in metals and solid helium. The pair-field susceptibility of superconductors is being studied. A propagating mode in the phase of the superconducting order parameter is under investigation. Superconducting fluctuations are being used to probe critical fluctuations in magnetic systems using the proximity effect. Heat capacities of superconducting films in the vicinity of T sub c are also being investigated. The properties of thin film solid solutions of sodium in ammonia are being studied. Nuclear orientation studies of the dilute magnetic impurity problem in metals in the 1 mK temperature region are being carried out. Refrigeration requirements for this work are being met using enhanced hyperfine nuclear cooling.
Author (GRA)

N77-24972# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
SUPERCONDUCTORS, MAGNETIC DETECTORS AND MAGNETIC ELECTRONICS Final Report
M. Tinkham 10 Nov. 1976 11 p refs
(Contracts N00014-76-C-0032; N00014-67-A-0298-0022)
(AD-A034361) Avail: NTIS HC A02/MF A01 CSCL 20/3

This report covers work in opening up the far infrared to useful application in the study of solids: finding and studying the energy gap in superconductors, first observation of antiferromagnetic resonance and exchange resonances in the far infrared, first observation of the temperature-dependent soft mode in ferroelectric crystals, first observation of the far-infrared absorption due to random charge in disordered systems, the effect of magnetic fields in creating gapless superconductors and the implications of fluxoid quantization for the critical fields of thin films and bulk superconductors. GRA

N77-24973# Massachusetts Inst. of Tech., Cambridge.
PHASE TRANSITIONS IN LIQUID CRYSTALS Final Technical Report, 1 Jul. 1972 - 30 Jun. 1976
J. David Litster 20 Jan. 1977 3 p refs
(Contracts N00014-76-C-0088; N00014-67-A-0204-0062)
(AD-A034874) Avail: NTIS HC A02/MF A01 CSCL 07/4

This report summarizes the results of light scattering studies of the nematic-isotropic and smectic A-nematic phase transitions in liquid crystals. Reference to ten resulting publications is given. Author (GRA)

N77-24974# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
INVESTIGATION OF TECHNOLOGICAL PROBLEMS IN GaAs Semiannual Technical Report, 16 Jan. - 15 Jul. 1976
Fred H. Eisen, John A. Higgins, G. D. Robinson, Bryant M. Welch, and Cheng P. Wen Aug. 1976 120 p refs
(Contract F19628-75-C-0113; ARPA Order 2489)
(AD-A034383; SC5017.13SAR; RADC-TR-76-342; SATR-3)
Avail: NTIS HC A06/MF 01 CSCL 09/1

Significant progress in areas of GaAs technology with impact on the development of microwave FET devices is reported. Improvement in the yield of bulk semi-insulating GaAs substrate material has been achieved by refining fabrication procedures. Transport measurements on semi-insulating GaAs have led to interpretation of the electrical compensation in terms of a deep-donor-deep-acceptor model. Transient capacitance measurements have confirmed that the growth of FET active layers on high-resistivity buffer layers results in the elimination of interface traps. In ion implantation, a simple annealing technique which avoids the use of any protective cap has been successfully applied to high dose Se implants. A test to preselect substrates for ion implantation has been developed, leading to good reproducibility of carrier concentration profiles. Accurate measurements of ionization coefficients have confirmed the dependence of electron ionization rates on doping density. Improved RF performance has been achieved from FET devices made on Se implanted layers. These devices are free from short term drift problems exhibited by transistors made on epitaxial layers. GRA

N77-24975# Harry Diamond Labs., Adelphi, Md.
A DIRECT TUNNELING MODEL OF CHARGE TRANSFER AT THE INSULATOR-SEMICONDUCTOR INTERFACE IN MIS DEVICES
Flynn B. McLean Oct. 1976 46 p refs
(DA Proj. 1T1-61102-B-11A)
(AD-A034436; HDL-TR-1765) Avail: NTIS HC A03/MF A01 CSCL 20/12

A general model of charge transfer at the insulator-semiconductor interface of metal-insulator-semiconductor (MIS) devices is developed. The model is based upon direct WKB tunneling of electrons from the semiconductor substrate into localized trap states within the forbidden gap of the insulator. Both an arbitrary distribution of the insulator states in energy as well as spatial variation in the trap densities in the interface region are treated. Advantage is taken of the strong spatial decay of the tunneling transition probability to obtain valid approximate solutions of the tunneling equations in a form directly amenable to numerical evaluation. The effects of internal electric fields in the insulator are included in a self-consistent manner. The results of several representative model calculations of post-irradiation annealing and field-injection characteristics of MIS capacitors are described. Author (GRA)

N77-24976# National Bureau of Standards, Washington, D. C. Electronic Technology Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: THE DOPANT DENSITY AND TEMPERATURE DEPENDENCE OF ELECTRON MOBILITY AND RESISTIVITY IN N-TYPE SILICON
Sheng S. Li Mar. 1977 37 p refs
(ARPA Order 2397)
(PB-264121/5; NBS-SP-400-33; LC-76-608381) Avail: NTIS HC A03/MF A01 CSCL 20L

Traditional analysis of electron mobility in n-type silicon neglects the effects of electron-electron scattering and scattering anisotropy in the mobility calculations. As a result, theory fails to conform with experiment when dopant density exceeds 2 x 10 to the 18th power/cc. An improved theoretical model for computing mobility and resistivity as functions of podant density and temperature was formulated for n-type silicon. The model was applied to phosphorus-doped silicon for dopant densities from 10 to the 13th power to 10 to the 19th power/cc, and temperatures between 100 and 500 K. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N77-24977# Idaho Univ., Moscow. Center for Applied Thermodynamic Studies.
GUIDE FOR USE OF COMPUTER PROGRAMS FOR THE CALCULATION OF THERMODYNAMIC PROPERTIES OF OXYGEN AND NITROGEN, SECOND EDITION
R. T. Jacobsen and R. B. Stewart Feb. 1976 108 p refs
(Grant NSF ENG-75-03275)
(PB-262898/0; CATS-76-2) Avail: NTIS HC A06/MF A01 CSCL 07D

The programs provide for the calculation of properties using a general 50 term functional form for the equation of state. The equations of state for oxygen and nitrogen are subsets of this general form. The equations for property calculations are given with explanations and listings of computer programs for the calculation of pressure, density, temperature, isochoric heat capacity, isobaric heat capacity, entropy, enthalpy, internal energy, and velocity of sound. The formulations were developed to allow the calculation of liquid properties by direct integration along isotherms through the two phase region. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-24978*# Battelle Columbus Labs., Ohio.
ANALYSIS OF THE EFFECTIVENESS OF INDUSTRIAL R AND D Final Report
W. Halder Fisher, Herbert S. Kleiman, John L. Moore, and Mark B. Triplett Oct. 1976 87 p refs
(Contract NASw-2800)
(NASA-CR-153001; BCL-OA-TFR-76-8) Avail: NTIS HC A05/MF A01 CSCL 05A

The criteria used by private industry in evaluating and selecting proposed research and development projects for implementation, and also in determining which R and D facilities are to be acquired were investigated. Conceptual and practical issues inherent in any quantitative analysis of the contribution of R and D to economic growth were identified in order to assist NASA in developing approaches for analzying the economic implication of its own R and D efforts. Author

N77-24979*# Battelle Columbus Labs., Ohio.
OPTIONS FOR ORGANIZATION AND OPERATION OF SPACE APPLICATIONS TRANSFER CENTERS Final Report
A. C. Robinson and J. A. Madigan 14 Jun. 1976 39 p
(Contract NASw-2800)
(NASA-CR-153005) Avail: NTIS HC A03/MF A01 CSCL 05A

The benefits of developing regional facilities for transfer of NASA developed technology are discussed. These centers are designed to inform, persuade, and serve users. Included will be equipment for applications and demonstrations of the processes, a library, training facilities, and meeting rooms. The staff will include experts in the various techniques, as well as personnel involved in finding and persuading potential users. Author

N77-24980*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMATIC VEHICLE MONITORING SYSTEMS STUDY. REPORT OF PHASE 0. VOLUME 1: EXECUTIVE SUMMARY
15 Mar. 1977 40 p Sponsored in part by NSF
(Contract NAS7-100)
(NASA-CR-153208; JPL-5040-26-Vol-1-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 05A

A set of planning guidelines is presented to help law enforcement agencies and vehicle fleet operators decide which automatic vehicle monitoring (AVM) system could best meet their performance requirements. Improvements in emergency response times and resultant cost benefits obtainable with various operational and planned AVM systems may be synthesized and simulated by means of special computer programs for model city parameters applicable to small, medium, and large urban areas. Design characteristics of various AVM systems and the implementation requirements are illustrated and cost estimated for the vehicles, the fixed sites, and the base equipments. Vehicle location accuracies for different RF links and polling intervals are analyzed. Author

N77-24981*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMATIC VEHICLE MONITORING SYSTEMS STUDY. REPORT OF PHASE 0. VOLUME 2: PROBLEM DEFINITION AND DERIVATION OF AVM SYSTEM SELECTION TECHNIQUES
30 Jun. 1976 108 p ref Sponsored in part by NSF
(Contract NAS7-100)
(NASA-CR-153207; JPL-5040-26-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 05A

A set of planning guidelines is presented to help law enforcement agencies and vehicle fleet operators decide which automatic vehicle monitoring (AVM) system could best meet their performance requirements. Improvements in emergency response times and resultant cost benefits obtainable with various operational and planned AVM systems may be synthesized and simulated by means of special computer programs for model city parameters applicable to small, medium and large urban areas. Design characteristics of various AVM systems and the implementation requirements are illustrated and cost estimated for the vehicles, the fixed sites and the base equipments. Vehicle location accuracies for different RF links and polling intervals are analyzed. Actual applications and coverage data are tabulated for seven cities whose police departments actively cooperated in the study. Author

N77-24982# National Science Foundation, Washington, D. C.
SCIENCE AT THE BICENTENNIAL: A REPORT FROM THE RESEARCH COMMUNITY. REPORT OF THE NATIONAL SCIENCE BOARD/1976
1976 165 p refs
(NSB-76-1) Avail: NTIS MF A01; SOD HC $2.95 as 038-000-00280-5

The views of over 600 representatives of the research community in universities, industry, government, and independent research institutes throughout the United States are provided on conditions affecting research or likely to affect it in the near future. Specifically they describe critical issues or problems they believe will decrease the effectiveness of research unless properly addressed. Emphasis was placed upon dependability of funding for research, the vitality of the research system, freedom in research choices, and attitudes toward science and technology. Author

N77-24983# Stanford Univ., Calif. Dept. of Statistics.
OPTIMIZATION OF RECURRENT CAPACITY EXPANSION MODELS AND GENERALIZATION TO A NON-RECURRENT MODEL
R. Scott Shipley 11 Oct. 1976 84 p refs
(Contract N00014-75-C-0561; NR Proj. 042-002)
(AD-A033429; SU-TR-180) Avail: NTIS HC A05/MF A01 CSCL 12/2

The determination of optimal expansion sizes $X^*(K)$-1, for

recurrent capacity expansion strategies of the form (X,K) where X-1 represents the expansion size undertaken whenever excess demand reaches the value K-1 is considered here, for fixed values K. A Policy Improvement algorithm is derived to determine optimal expansion sizes for general expansion functions. For a certain class of expansion functions, which includes discrete convex functions, it is shown that the expected discounted costs are unimodal in the expansion size and that the optimal expansion size X*(K)-1 increases monotonically with K; an Interval-Bisection algorithm is given to determine X*(K) for this case. The monotonicity of the optimal expansion size is also demonstrated, prior to integer-truncation, for important classes of concave expansion functions which are continuously differentiable; a simple Function Iteration algorithm is derived to determine optimal expansion size for this case. GRA

N77-24984# Stanford Univ., Calif. Dept. of Operations Research.
A RENEWAL DECISION PROBLEM
C. Derman, Gerald J. Lieberman, and S. Ross 15 Aug. 1976 19 p refs
(Contract N00014-75-C-0561)
(AD-A033777; SU-TR-177) Avail: NTIS HC A02/MF A01 CSCL 12/2

Given a system which operates for t units of time and a certain component is essential for its operation and must be replaced, when it fails, with a new component. The class of spare components is grouped into n categories with components of the ith category costing a positive amount Ci and functioning for an exponential length of time with rate lambda(i). The main problem of interest is, for a given t, to assign the initial component and subsequent replacements from among the n categories of spare components so as to minimize the expected cost of providing an operative component for t units of time. GRA

N77-24985# Wisconsin Univ., Madison. Dept. of Computer Sciences.
THE FORMAL DESIGN AND ANALYSIS OF DISTRIBUTED DATA PROCESSING SYSTEMS Special Report, 1 Jul. - 30 Oct. 1976
Donald R. Fitzwater 30 Oct. 1976 172 p refs
(Contract DASG60-76-C-0080)
(AD-A033888; CSTR-279) Avail: NTIS HC A08/MF A01 CSCL 09/2

The research proposal is to support the development of the 'science' behind software engineering in order to ensure required system properties, to compare current software engineering techniques, to develop specification for new design and analysis tools, and to demonstrate the practicality of the 'science'. A hierarchical design schema will be developed within which formal representations and analyses can be defined and the required solutions can be found. Since 'worst case' problems are generally impossible to solve, sufficient design laws or constraints will be developed to ensure solvability of the critical problems. Author (GRA)

N77-24986# Harry Diamond Labs., Adelphi, Md.
RECALL: A MANAGEMENT INFORMATION RETRIEVAL SYSTEM FOR THE WANG 2200
Howard M. Bloom Nov. 1976 59 p
(AD-A034427; HDL-TM-76-36) Avail: NTIS HC A03/MF A01 CSCL 05/2

A data-base language called RECALL has been implemented on the Wang 2200 programmable desk calculator. The language was patterned after RETRIEVE, developed by Tymshare, Inc., for its time-sharing network. Differences between the two implementations are very minor. The report describes each command in the language and gives a comprehensive example to illustrate how the entire system can be used. The listing of the program allows the reader to make modifications, if necessary. The RECALL system is implemented on a 2200C calculator with 16k bytes of memory and a model 2230 disk used for temporary storage of the overlay segments needed for running the program. The system assumes that the data bases will be permanently saved on tape cassette. Author (GRA)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N77-24987*+ National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY, SECTION 2: INDEXES, JANUARY 1977
Jan. 1977 536 p refs
(NASA-SP-7039(10)) Avail: NTIS HC E04 CSCL 05B

Abstracts for 3089 patents and applications for patent entered in the NASA scientific and information system for the period covering May 1969 through December 1976 are indexed by subject, inventor, source, NASA case or U.S. patent number, and accession number in the NASA system. Author

N77-24988*# Operations Research, Inc., Silver Spring, Md.
UNITED STATES DATA COLLECTION ACTIVITIES AND REQUIREMENTS, VOLUME 1 Final Report
S. Hrin and D. McGregor Jan. 1977 248 p refs
(Contract NAS5-22467)
(NASA-CR-152523; TR-1124-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 05B

The potential market for a data collection system was investigated to determine whether the user needs would be sufficient to support a satellite relay data collection system design. The activities of 107,407 data collections stations were studied to determine user needs in agriculture, climatology, environmental monitoring, forestry, geology, hydrology, meteorology, and oceanography. Descriptions of 50 distinct data collections networks are described and used to form the user data base. The computer program used to analyze the station data base is discussed, and results of the analysis are presented in maps and graphs. Information format and coding is described in the appendix. Author

N77-24989*# Operations Research, Inc., Silver Spring, Md.
UNITED STATES DATA COLLECTION ACTIVITIES AND REQUIREMENTS, VOLUME 2 Final Report
S. Hrin and D. McGregor Jan. 1977 196 p refs
(Contract NAS5-22467)
(NASA-CR-152524; TR-1124-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 05B

A listing of the entire data collection station data base is presented. Author

N77-24990# Gary (Philip J.) and Associates, Marina Del Rey, Calif. Micrographic Systems Consulting Services.
DEVELOPMENT OF A MODEL LIBRARY MICROFORM CENTER
Philip J. Gary Aug. 1976 56 p refs Sponsored by EPA
(PB-263586/0; EPA-LIB-76-10) Avail: NTIS HC A04/MF A01 CSCL 05B

Trends in micropublishing are discussed. Problems encountered in acquisition, processing, storing, and retrieving microforms in libraries and other collections are examined. Recommendations are given for furniture and lighting, and criteria for retrieval equipment selection are included. A.R.H.

N77-24991# Lehigh Univ., Bethlehem, Pa. Center for Information Science.
A STUDY OF INFORMATION REGENERATION FOR KNOWLEDGE TRANSFER Final Report, 1 Nov. - 30 Apr. 1975
Donald J. Hillman Oct. 1975 50 p refs
(Grant NSF GN-40900)
(PB-263342/8; INFO-REGEN-1) Avail: NTIS HC A03/MF A01 CSCL 05B

The LEADERMART information system was used as the basis for a study to determine the foundations of information regeneration as the preliminary step toward the creation of a knowledge transfer system. It was assumed that a network of

information processors and algorithms as are now used will be combined with still undeveloped management policies. Capabilities of the LEADERMART system were enhanced by developing a new question analyzer called QUANSY, and a new file organization for data retrieval. The notion of usable forms was redefined, and an information regeneration theory constructed. GRA

N77-24992# Southwest Research Inst., San Antonio, Tex.
EVALUATION OF SINGLE-AND MULTICOLOR MAP AND CHART REPRODUCTION EQUIPMENT Final Report, 26 Feb. - 1 Nov. 1976
E. J. Baker and M. A. Sissung Nov. 1976 91 p
(Contract DAAG53-76-C-0094)
(AD-A033847; ETL-0080) Avail: NTIS HC A05/MF A01 CSCL 14/5

This report covers the results of the investigation to determine the ability of state-of-the-art printing technologies to meet the military requirements for a quick reaction/limited quantity map and chart reproduction capability. The processes covered are aimed at meeting the requirements for single and multicolor reproduction. These requirements include: input, output, speed and quality of the reproduction, as well as restrictions on size, weight, and environmental operating conditions. Covered in this report are the printing technologies which are considered to be the best candidates. Each of the methods are briefly described and the acceptable, marginally acceptable, and unacceptable characteristics as they relate to the military requirements are discussed. Specific additional comments are made about several of the processes and a representative list of manufacturers for each process is included. Author (GRA)

N77-24993# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
HIGH LEVEL EXPRESSION OF SEMANTIC INTEGRITY SPECIFICATIONS IN A RELATIONAL DATA BASE SYSTEM M.S. Thesis
Dennis J. McLeod Sep. 1976 123 p refs
(Contract N00014-75-C-0661)
(AD-A034184; MIT/LCS/TR-165) Avail: NTIS HC A06/MF A01 CSCL 09/2

The 'semantic integrity' of a data base is said to be violated when the data base ceases to represent a legitimate configuration of the application environment it is intended to model. In the context of the relational data model, it is possible to identify multiple levels of semantic integrity information: (1) the description of the domains of the data base as abstract sets of atomic data values (domain definition), (2) the specification of the fundamental structure of the relations of the data base (relation structure specification), (3) the definition of the abstract operations which are meaningful in terms of the application environment (structured operations), and (4) the expression of additional semantic information not contained in the structure of the relations nor in the identities of their underlying domains (relation constraints). A high level, nonprocedural domain definition language facilitates the description of domains. Such a language allows the specification of the properties of the values constituting a domain, and the action that is to occur if an attempt is made to update a column entry such that it does not belong to the underlying domain of that column. The specification of relation structure and structured operations can be accomplished by means of high level integrity (sub)languages. A semantic integrity subsystem (of a generalized relational data base management system) can support the generation and maintenance of integrity specifications, verify that these specifications are met by the data base, and take appropriate action if violations are detected. GRA

N77-24994# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
INDEX SELECTION IN A SELF-ADAPTIVE RELATIONAL DATA BASE MANAGEMENT SYSTEM M.S. Thesis
Arvola Y. Chan Sep. 1976 100 p refs
(Contract N00014-75-C-0661)
(AD-A034185; MIT/LCS/TR-166) Avail: NTIS HC A05/MF A01 CSCL 09/2

The development of large integrated data bases that support a variety of applications in an enterprise promises to be one of the most important data processing activities of the next decade. The effective utilization of such a data base depends on the ability of data base management systems to cope with the evolution of data base applications. In this thesis, development of a methodology for monitoring the developing pattern of access to a data base and for choosing near-optimal physical data base organizations based on the evidenced mode of use is attempted. More specifically, the problem of adaptively selecting the set of secondary indices to be maintained in an integrated relational data base is considered. Stress is placed on the acquisition of an accurate usage model and on the precise estimation of data base characteristics, through the use of access monitoring and the application of forecasting and smoothing techniques. GRA

N77-24995# System Development Corp., Santa Monica, Calif.
ICE DEDUCTIVE PROCESSOR AND ITS INTERFACE WITH THE REL SYSTEM Final Technical Report, Jan. 1974 - Mar. 1975
Charles Kellogg and Philip Klahr Nov. 1976 308 p refs
(Contract F30602-75-C-0106; AF Proj. 4594)
(AD-A033931; RADC-TR-76-258) Avail: NTIS HC A14/MF A01 CSCL 09/2

The ICE (Inferential Construction of Evidence) deductive processor is a prototype system for realizing plausible deductive inference in an on-line environment consisting of large quantities of both general information (inference rules or premises) and concrete data (specific facts). It facilitates data analysis by deriving implicit information from collections of data base values under user control. The ICE processor is described as is its interface with the REL system. A number of examples in the form of computer printouts are used to illustrate the operation of the current REL/ICE prototype. GRA

N77-24996# Commerce Technical Advisory Board, Washington, D.C.
PROCEEDINGS OF THE COLLOQUIUM ON THE SCIENCE COURT
Jan. 1977 345 p Proc. held at Leesburg, Va., 19-21 Sep. 1976 Sponsored in part by AAAS and NSF
(PB-261305/7) Avail: NTIS HC A15/MF A01 CSCL 05B

The development of a procedure for finding the state of scientific fact at a time when the best available factual basis is needed for public policy making on important controversial issues is discussed. It is proposed that this fact finding will be built on experience in both the legal and the scientific communities. The Science Court concept for dealing with scientific controversy in making public policy is explored. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N77-24997# Brookhaven National Lab., Upton, N.Y.
STUDY TO ASSESS THE APPLICATION OF SHADOW PRICING TECHNIQUES TO NATIONAL ENERGY RESOURCE PLANNING Final Report, Year 1
Jun. 1976 158 p refs
(Contract E(30-1)-16; Grant NSF SIA-74-02555-01)
(BNL-50537) Avail: NTIS HC A08/MF A01

The dynamic energy system optimization model analyzes optimal allocation of exhaustible energy resources over time. It is a multi-period representation of the nation's energy supply and utilization system that incorporates cost and time elements associated with new capital facilities, the discount rate, internal selection of new energy technologies, and internal determination of primary energy resource allocation over time. Applications of a single-period energy model demonstrate obtaining first estimates benefit/cost ratios for federal R and D investment in the high-Btu coal-gasification technology, and evaluating the economic impact of a sulfur dioxide emission constraint in certain end uses. ERA

N77-24998# Brookhaven National Lab., Upton, N.Y. Economic Analysis Div.
ECONOMY-WIDE IMPACTS OF INTERFUEL SUBSTITUTION: SUBSTITUTION OF ELECTRICITY FOR IMPORTED OIL

R. G. Tessmer, Jr. and J. Lukachinski Jun. 1976 63 p refs
(Contract E(30-1)-16)
(BNL-50538) Avail: NTIS HC A04/MF A01

An energy input-output model is applied to analysis of the long-run effects (to 1985) of higher oil prices in the U.S. economy. Aspects investigated are the effects of sustained, higher international oil prices, and the effects of substituting domestic-coal-produced electricity for high-priced foreign oil. Variables examined include capital investment, personal consumption expenditures, exports and imports, labor force, and energy production. ERA

N77-24999# Brookhaven National Lab., Upton, N.Y. Economic Analysis Div.
EFFECTS OF ALTERNATIVE OIL STOCKPILING PROGRAMS ON THE US ECONOMY, 1976-1979 Final Results
R. G. Tessmer, Jr. and D. J. Behling; Jr. Jun. 1976 48 p refs
(Contract E(30-1)-16)
(BNL-50541) Avail: NTIS HC A03/MF A01

Application of Brookhaven's energy input-output model is demonstrated by analyzing economy-wide effects of an oil stockpile program. The model is used to estimate the 1976-79 inter-industry output, employment, capital, and energy substitution effects of 730- and 4,380-barrel stockpiles. Two policy variables (the type of stockpile facility and the method of financing) and one assumption (balance of payments effects) are examined. ERA

N77-25000# Battelle Pacific Northwest Labs., Richland, Wash.
REVIEW AND ASSESSMENT OF ENGINEERING ECONOMIC STUDIES OF DRY COOLED ELECTRICAL GENERATING PLANTS
B. C. Fryer Mar. 1976 100 p refs
(Contract E(45-1)-1830)
(BNWL-1976) Avail: NTIS HC A05/MF A01

The major U.S. studies conducted between 1970 and 1975 on the economics of dry cooled electrical generating plants were reviewed to collect, compare, and summarize the approaches, assumptions, and results of several major studies on dry cooling engineering economics, and to evaluate the computer codes associated with these economic studies. It is concluded that adequate detailed evaluation of state-of-the-art dry cooling systems has not been conducted and that comprehensive computer programs capable of such evaluations are not publicly available. Methods for determining power production costs of dry cooled plants are recommended. ERA

N77-25001# Air Force Contract Management Div., Kirtland AFB, N.Mex.
A METHODOLOGY FOR ESTIMATING JET ENGINE COSTS EARLY IN WEAPON SYSTEM ACQUISITION
Michael A. Yanke 1 Aug. 1976 38 p ref
(AD-A033667) Avail: NTIS HC A03/MF A01 CSCL 21/5

The Department of Defense (DOD) is deeply concerned about developing accurate initial estimates for weapon system production costs. An area of particular interest is providing estimates of future production costs for jet engines. Current parametric models used by the Air Force identify engine cost as a function of output variables. Other DOD agencies consider relating input variables as well as output variables to production costs. This study was designed to find a better way to estimate engine production costs. The results of this research include the following findings: (1) current Air Force cost-estimating models are operationally ineffective; (2) raw materials-related variables are highly correlated with cost and should be considered in developing future cost-estimation models; (3) statistical validation of cost models should incorporate confidence interval testing at a specified alpha level for each prediction; and (4) the use of confidence intervals is the correct statistical approach for developing cost estimates which may be used in decision making. Author (GRA)

N77-25002# Utah State Univ., Logan. Dept. of Economics.
THE RELATIONSHIP OF TECHNOLOGICAL CHANGE AND THE DEMAND FOR AND SUPPLY OF RAW MATERIALS. VOLUME 1: EXECUTIVE SUMMARY Final Report
James P. Gander Jul. 1976 25 p 1 Vol.
(Grant NSF PRA-74-20198)
(PB-263852/6; NSF/PRA-7420198/1/7-Vol-1) Avail: NTIS HC A02/MF A01; also available in set of 3 reports, PB-263851-SET, HC E12 CSCL 05C

This state-of-the-art project compiles and assesses the literature relevant to the effects of technological change on demand for and supply of raw materials. The study relates: (1) what is presently known on the subject; (2) the extent to which our knowledge limits our choice of raw materials policy options; (3) possible alternative policy options; and (4) types of information or research needed to improve our capability to choose among these options. GRA

N77-25003# Utah State Univ., Logan. Dept. of Economics.
THE RELATIONSHIP OF TECHNOLOGICAL CHANGE AND THE DEMAND FOR AND SUPPLY OF RAW MATERIALS. VOLUME 2 Final Report
James P. Gander Jul. 1976 180 p refs 2 Vol.
(Grant NSF PRA-74-20198)
(PB-263853/4; NSF/PRA-7420198/2/7-Vol-2) Avail: NTIS HC A09/MF A01; also available in set of 3 reports, PB-263851-SET, HC E12 CSCL 05C

For abstract, see N77-25002.

N77-25004# Utah State Univ., Logan. Dept. of Economics.
THE RELATIONSHIP OF TECHNOLOGICAL CHANGE AND THE DEMAND FOR AND SUPPLY OF RAW MATERIALS. VOLUME 3: ANALYTICAL APPENDICES AND ABSTRACTS Final Report
James P. Gander Jul. 1976 617 p refs 3 Vol.
(Grant NSF PRA-74-20198)
(PB-263854/2; NSF/PRA-7420198/3/7-Vol-3) Avail: NTIS HC A99/MF A01; also available in set of 3 reports, PB-263851-SET, HC E12 CSCL 05C

The economic and technical literature on how technological change is related to the demand for and supply of raw materials is determined. This knowledge is assessed, and gaps are identified in it for future research. Based on this knowledge, government policy makers should have an improved information base upon which to formulate and assess alternative technological options. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N77-25005*# Battelle Columbus Labs., Ohio.
REVIEW OF R AND D ON WATER HYACINTH UTILIZATION IN THE PHILIPPINE REPUBLIC Final Report
J. L. Otis and M. E. D. Hillman Nov. 1976 50 p
(Contract NASw-2800)
(NASA-CR-153002; BCL-OA-TFR-76-9) Avail: NTIS HC A03/MF A01 CSCL 06C

The operations of a Filipino inventor were observed with a view toward determining the technical-economic potential of his hyacinth utilization concepts if the highly fibrous portion of the plant were separated from the other components. Subjects of

particular interest include: (1) water hyacinth harvesting techniques, volumes and costs; (2) hyacinth defibering processes; and (3) uses of hyacinth materials for production of animal feeds, paper fibers, particle boards, acoustic and insulation boards, various vitamins and minerals (especially Vitamin A), food products, pesticides, and medicinal and pharmaceutical products. Author

N77-25006*# Battelle Columbus Labs., Ohio.
TECHNOLOGY TRANSFER POTENTIAL OF AN AUTOMATED WATER MONITORING SYSTEM Final Report
W. M. Jamieson, M. E. D. Hillman, M. A. Eischen, and J. M. Stilwell 28 May 1976 89 p refs
(Contract NASw-2800)
(NASA-CR-153004; BCL-OA-TFR-76-6) Avail: NTIS HC A05/MF A01 CSCL 08H

The nature and characteristics of the potential economic need (markets) for a highly integrated water quality monitoring system were investigated. The technological, institutional and marketing factors that would influence the transfer and adoption of an automated system were studied for application to public and private water supply, public and private wastewater treatment and environmental monitoring of rivers and lakes. Author

N77-25007# Commerce Dept., Washington, D.C. Patent and Trademark Office.
TECHNOLOGY ASSESSMENT AND FORECAST
Mar. 1977 218 p refs
(Rept-7) Avail: NTIS HC A10/MF A01

A historical perspective of patents and trademarks is presented along with a description of international patenting patterns. Recent activity is assessed in chemical, electrical, and mechanical engineering, and developments in telemetry, cardiography, optical waveguides, and prostagladins are evaluated. Computer memory components and antipollution patenting are explored in depth. U.S. patent activity since 1790 is given in tabular form. Instructions for obtaining additional information or special reports are included. A.R.H.

N77-25008*# Stanford Univ., Calif. School of Medicine.
[BIOMEDICAL TECHNOLOGY TRANSFER: BIOINSTRUMENTATION FOR CARDIOLOGY, NEUROLOGY, AND THE CIRCULATORY SYSTEM] Quarterly Report, Oct. - Dec. 1976
Dec. 1976 70 p refs
(Grant NGR-05-020-634)
(NASA-CR-152851) Avail: NTIS HC A04/MF A01 CSCL 05A

Developments in applying aerospace medical technology to the design and production of medical equipment and instrumentation are reported. Projects described include intercranial pressure transducers, leg negative pressure devices, a synthetic speech prosthesis for victims of cerebral palsy, and a Doppler blood flow instrument. Commercialization activities for disseminating and utilizing NASA technology, and new biomedical problem areas are discussed. A.R.H.

N77-25009# Los Alamos Scientific Lab., N. Mex.
USER'S GUIDE TO THE BOOM1 MODEL
A. Ford Aug. 1976 59 p refs Sponsored in part by EPA
(Contract W-7405-eng-36)
(LA-6396-MS) Avail: NTIS HC A04/MF A01

A computer model designed to simulate the 'boom town' impacts of locating large power plants near small, isolated communities is described. Individual equations and parameter estimates are shown to provide the following information needed to judge BOOM1's usefulness: list of factors not included in the model; causal influence diagrams of vicious circles which act to worsen boom town conditions; flow diagrams in the power plant, housing, public construction and municipal finance, retail and services facilities, and migration sectors; numerous plots of model variables over a time span encompassing the pre-boom construction, and operation phases of boom town development; results of tests showing the sensitivity of the model to alternative estimates of parameters; results of illustrative policy simulations showing the effectiveness of front end money, public loan guarantees, and guaranteed loans to the retail and services investor; and a list of potential applications of the model by national, state, local, and energy company officials. ERA

N77-25010# Los Alamos Scientific Lab., N. Mex.
SUMMARY DESCRIPTION OF THE BOOM1 MODEL
A. Ford Jun. 1976 14 p refs
(Contract W-7405-eng-36)
(LA-6424-MS) Avail: NTIS HC A02/MF A01

The principal features of a computer program modeling boom town impacts are described. Model outputs include population, permanent and mobile homes, public facilities and municipal debt, local property tax rate and state transfer payments, construction work force, construction productivity, and retail and services facilities. The model can be used to simulate the behavior of these variables over a time span covering the pre-boom, construction, operation, and retirement phases of an energy project. The model runs may be interrupted in any year to simulate the effectiveness of assistance measures that have been proposed by national, state, local, and energy company officials. ERA

N77-25011# Aerospace Corp., Germantown, Md.
ENERGY RECOVERY FROM MUNICIPAL SOLID WASTE, AN ENVIRONMENTAL AND SAFETY MINI-OVERVIEW SURVEY
R. L. Johnson Jun. 1976 181 p refs
(Contract E(04-3)-1101)
(ATR-76(7518)-7) Avail: NTIS HC A09/MF A01

The environmental and safety aspects of processing municipal solid wastes to recover energy and materials are reviewed in some detail. The state of the art in energy recovery, energy potential for the near and long-term, and constraints to commercialization are discussed. Under the environmental and safety aspects the state of the art, need for research and development, and need for coordination among federal agencies and private industry are considered. Eleven principal types of refuse-to-energy processes are described, and a projected energy balance is derived for each process. ERA

N77-25012# Envirotech Corp., Salt Lake City, Utah. Eimco BSP Div.
PHYSICAL-CHEMICAL TREATMENT OF A MUNICIPAL WASTEWATER USING POWDERED CARBON, NO. 2
Don E. Burns, Richard N. Wallace, and Darrell J. Cook Nov. 1976 349 p refs
(Contract EPA-68-01-0183)
(PB-263134/9; EPA-600/2-76-235) Avail: NTIS HC A15/MF A01 CSCL 13B

Salt Lake City municipal wastewater was treated in a nominal 100 gpm pilot plant by chemical coagulation-precipitation, powdered activated carbon adsorption and granular media filtration. Chemical-primary sludge and spent carbon were gravity thickened and vacuum filter dewatered. Soluble organic materials were removed by a combination of chemical coagulation, anaerobic biological activity and adsorption on powdered carbon. Spent powdered carbon was effectively regenerated with an average fixed carbon recovery of 90 percent. A high quality effluent was consistently produced. GRA

N77-25013# Battelle Columbus Labs., Ohio.
DEVELOPMENT OF PREDICTIVE CRITERIA FOR DEMOLITION AND CONSTRUCTION SOLID WASTE MANAGEMENT Final Report
K. S. Murthy and S. Chatterjee Oct. 1976 142 p refs
(Contract DACA88-75-C-0015; DA Proj. 4A7-627720-A-896)
(AD-A033646; CERL-TR-N-15) Avail: NTIS HC A07/MF A01 CSCL 13/3

This report presents a detailed review of existing demolition techniques and alternatives. Demolition techniques discussed include: (1) manual wrecking, (2) mechanical demolition, (3) demolition with explosives, and (4) underwater demolition. Types of equipment employed for each technique are described in detail. The operating features, applicability of the demoliton method, cost data, environmental impacts, and safety considerations associated with each technique are detailed. The salvage and reclamation aspects of demolition waste are explained. Data collected by field visits to several Army and Civilian demolition sites are tabulated and analyzed to present predictive tools for estimation of waste volume, composition, and cost of disposal for a given project. Waste data from construction sites are presented and analyzed similarly, and can be considered a pioneering effort. GRA

N77-25014# Pennsylvania Univ., Philadelphia. Wharton School of Finance and Commerce.
IMPACT OF A SUBURBAN RAPID TRANSIT LINE OF FUEL CONSUMPTION AND COST FOR THE JOURNEY-TO-WORK. ANALYSIS OF THE PHILADELPHIA-LINDENWOLD HIGH-SPEED LINE Final Report
David E. Boyce, Khanh Nguyen, Thierry Noyelle, and Kent Webb Dec. 1975 74 p refs
(Contract DI-14-01-0001-1700)
(PB-263048/1; FEA/D-77/023) Avail: NTIS HC A04/MF A01 CSCL 13B

Two analyses of the Philadelphia-Lindenwold High-Speed Line are presented which are potentially useful for evaluating the potential of similar transit systems for conserving energy. First, the electrical energy consumption, fuel consumption and fuel cost per passenger-mile and car-mile are estimated from operating data, and compared with estimates for auto and bus modes. Second, these estimates are applied to the 1970 census journey-to-work data to estimate person-miles of travel, fuel consumption and fuel cost by mode, origin and destination for an actual commuting situation. GRA

N77-25015# Voorhees (Alan M.) and Associates, Inc., McLean, Va.
STUDY OF FUTURE PARATRANSIT REQUIREMENTS: SCENARIO REPORT Interim Report
Nov. 1976 233 p
(Contract DOT-UT-50023)
(PB-262629/9; UMTA-IT-06-0104-77-1) Avail: NTIS HC A11/MF A01 CSCL 13B

The future dimensions and characteristics of paratransit and the requirements for testing innovative transportation services for the development of new vehicles, and for ways to overcome legal and institutional constraints, are defined. The analysis is based on urban scenarios projected into the 1980-95 time frame and representative of a large number of locations. The report describes how these scenarios were constructed and evaluated and how the findings were aggregated for the entire U.S. GRA

N77-25016# Utah Water Research Lab., Logan.
USER ORIENTED SYSTEMS ANALYSIS FOR REGIONAL MUNICIPAL WATER SUPPLY PLANNING
Paul E. Pugner and Trevor C. Hughes Jul. 1976 111 p refs
(Contract DI-14-34-0001-6127)
(PB-262243/9; PRWA23-1; W77-03159; QWRT-B-125-Utah(2)) Avail: NTIS HC A06/MF A01 CSCL 13B

An interactive data and model generator is developed that is intended to bridge the gap between planning engineers and the mathematical programming systems approach to municipal and regional water supply planning. A matrix generator is developed which formulates the necessary hydrologic, demographic and stochastic municipal water supply data into the format of a mixed integer linear programming problem for system optimization. The program then calls the integer programming algorithm, solves the optimization problem, and outputs a report in a format and language designed specifically for the problem at hand. GRA

N77-25017# Transportation Research Board, Washington, D. C.
DUAL MODE TRANSPORTATION: PROCEEDINGS OF A CONFERENCE CONDUCTED BY THE TRANSPORTATION RESEARCH BOARD
Daniel Brand 1976 149 p Conf. held at Washington, D. C., 29-31 May 1974
(PB-262257/9; TRB/SR-170; ISBN-0-309-02552-4) Avail: NTIS HC A07/MF A01 CSCL 13B

A substantial basis for analysis and evaluation of dual-mode transportation as a solution to urban transportation requirements is presented. GRA

N77-25018# Transportation Research Board, Washington, D. C.
TRANSPORTATION PROGRAMMING, ECONOMIC ANALYSIS, AND EVALUATION OF ENERGY CONSTRAINTS
Greig W. Harvey, Elizabeth A. Deakin, Ronald R. Knox, Theodore K. Martin, and William J. Yuskus 1976 74 p refs
(PB-262878/2; TRB/TRR-599; ISBN-0-309-02568-0) Avail: NTIS HC A04/MF A01 CSCL 13B

State and local roles in transportation control planning, programming highway improvements in new funding environment, highway investment analysis package, improving the process of programming transportation investments, and gasoline consumption in urban traffic are analyzed. Energy analysis for urban transportation systems, a use of dis-aggregate travel demand models to analyze car pooling policy incentives, new technique for evaluating urban traffic energy consumption and emissions, and energy conservation potential of urban public transit were calculated. GRA

N77-25019# Recon Systems, Inc., Princeton, N. J.
MUNICIPAL-SCALE THERMAL PROCESSING OF SOLID WASTES Final Report
Norman J. Weinstein 1977 365 p refs
(Contract EPA-68-03-0293)
(PB-263396/4; EPA-530/SW-133c) Avail: NTIS HC A16/MF A01 CSCL 13B

The state of the art for the thermal processing of solid waste is described. Subjects covered include: costs, site selection, plant design, utilities, weighing, handling, furnace design, energy recovery, pyrolysis, instrumentation, air pollution control, acceptance evaluation, operation and maintenance. GRA

N77-25020# North Carolina Univ., Chapel Hill.
CITY CENTERS IN TRANSITION
Shirley F. Weiss Aug. 1976 106 p Presented at the Environmental Design Conf., Chapel Hill, N. C., 6-8 Jun. 1976
(Grant NSF ENV-76-17695)
(PB-262337/9; NSF/RA-760212) Avail: NTIS HC A06/MF A01 CSCL 13B

An improved basis for (1) identifying the critical processes and decisions that are transforming city centers; and (2) isolating key research needs and identifying their significance for public policy is discussed. The problems of city centers have physical, fiscal, and social dimensions that are too difficult for government or business to solve alone. A balanced partnership between the public and private sectors can increase total effectiveness. GRA

N77-25021# Lehigh Univ., Bethlehem, Pa. Div. of Urban Studies.
DESIGN OF MUNICIPAL SERVICES IN SUPPORT OF HIGH RISE OFFICE BUILDINGS
Leonard I. Ruchelman and Charles N. Brownstein May 1975 428 p refs
(PB-262532/5; NSF/RA/S-75-101) Avail: NTIS HC A19/MF A01 CSCL 13B

Transporting large numbers of people in and out of high density districts, meeting the growing demand for sewage, water and energy services, assuring the visual and functional compatibility of large structures with the environment, and delivering effective police and fire protection were examined in cities where extensive tall building development is manifest. Focusing on two highrise office building projects in New York City--the Pan Am Building and the World Trade Center--how the decision-making contributes or fails to contribute to environmental concerns is discussed. GRA

N77-25022# Delaware Univ., Newark. Dept. of Civil Engineering.
DYNAMIC RESPONSE OF FINAL SETTLING TANKS TO TRANSIENT LOADING CONDITIONS M.S. Thesis
Dana R. Pizarro Jun. 1976 156 p refs
(PB-262359/3; W77-03156; OWRT-A-015-DEL(4)) Avail: NTIS HC A08/MF A01 CSCL 13B

The continuous thickener was divided into three regions: a uniform clarification zone, a uniform area intermediate region below the feed inlet and above the bottom zone, and a conically-shaped bottom zone for modeling purposes. Verification of the proposed model was accomplished by performing nonsteady state continuous thickening experiments using a calcium carbonate suspension. Nonsteady state operation was achieved by imposing step transients of the applied flux and the underflow withdrawal rate on a continuous thickener previously maintained at steady state conditions. A comparison of the model simulations and the laboratory data indicated that the concepts

employed during the modeling provided a satisfactory description of dynamical conditions. GRA

N77-25023# Colorado State Univ., Fort Collins.
PROCEEDINGS: WILLIAMSBURG CONFERENCE OF MANAGEMENT OF WASTEWATER RESIDUALS
J. L. Smith, ed. and E. H. Bryan, ed. Jul. 1976 170 p refs Proc. held at Williamsburg, Va., 13-14 Nov. 1975 Prepared in cooperation with Hampton Roads Sanitation District, Virginia Beach, Va.
(Grant NSF AEN-74-08082)
(PB-262544/0; NSF/RA-760362) Avail: NTIS HC A08/MF A01 CSCL 13B

Research directed toward management of residuals, continuous subsurface injection of wastewater residuals, subsurface injection of wastewater residuals at the city of Boulder and effects of wastewater residuals on soils and groundwater were reviewed. Management of environmental problems, survival of pathogens in soils, high energy electron irradiation of wastewater residuals and integration of unit operations in wastewater residuals management were examined. Optimization of continuous subsurface injection of sewage sludge, legal aspects of land application of wastewater residuals, a preview of EPA's bulletin on municipal sludge management and residual management--industrial concern was surveyed. GRA

N77-25024# Transportation Research Board, Washington, D. C.
USE OF WASTE MATERIALS AND SOIL STABILIZATION
Raymond A. Forsyth 1976 72 p refs
(PB-262239/7; TRB/TRR-593; ISBN-0-309-02562-1) Avail: NTIS HC A04/MF A01 CSCL 13C

Use of waste materials in embankment construction, waste use in highway construction, and use of ash in embankment construction were studied. Construction of fly ash roadway embankment in Illinois, improvement of dispersive clay erosion resistance by chemical treatment, and chemical stabilization for control of dust and traffic erosion are covered. Elastic and viscoelastic behavior of a chemically stabilized sand, electrochemical hardening of expansive clays, stabilization of sands by asphalt emulsion, and establishing a construction cutoff date for placement of aggregate-lime pozzolan are discussed. GRA

N77-25025# Milwaukee Sewerage Commission, Wisc.
WASTEWATER FLOW MEASUREMENT IN SEWERS USING ULTRASOUND
R. J. Anderson, S. S. Bell (Badger Meter, Inc., Milwaukee), W. H. VanderHeyden (Badger Meter, Inc., Milwaukee), and W. K. Genthe (Badger Meter, Inc., Milwaukee) Nov. 1976 113 p refs
(PB-262902/0; EPA-600/2-76-243) Avail: NTIS HC A06/MF A01 CSCL 13B

A technique for measurement of sewage volume flow utilizing ultrasonic measurements of depth and velocity. The technique, requiring no costly construction for installation, is usable for open channel or partially full measurements. The flow technique can accomplish measurement accuracies from 2 to 5% under conditions of rapidly changing levels, surcharging, and back-up conditions. Two installations were accomplished on existing sewers in the Milwaukee Sewage System, one 12 1/2 feet and the other 5 feet in diameter. A continuous flow record was displayed for each meter and performance of the meter installations was compared with magnetic flow meters at one site and head velocity relations on the other site. GRA

N77-25026# Research Triangle Inst., Research Triangle Park, N. C.
RANN UTILIZATION EXPERIENCE (CASE STUDIES 22 THROUGH 31) Final Report
R. M. Burger and M. F. Massoglia Aug. 1976 288 p refs 2 Vol.
(Contract NSF C-76-17165)
(PB-263682/7; NSF/RA-760412) Avail: NTIS HC A13/MF A01 CSCL 05B

The extent of utilization of Research Applied to National Needs research projects initiated in February 1972 and February 1973 was investigated. Case studies presented explore: (1) development of X-ray fluorescence analysis and application to atmospheric aerosols; (2) dredge spoil distribution and estuarine effects; (3) laboratory cloud simulation to support weather modification research and field programs; (4) feasibility study: coordination of data collection activities on the nation's building inventory; (5) biological conversion of organic refuse to methane; (6) fire and smoke spread in corridors; (7) computer abuses; (8) problems and research priorities in the Rocky Mountain region; (9) development of a plan to maximize the learning from destructive earthquakes; and (10) research and development of lithium/sulfur secondary batteries. GRA

N77-25027# Research Triangle Inst., Research Triangle Park, N. C.
RANN UTILIZATION EXPERIENCE (CASE STUDIES 32 THROUGH 41) Final Report
T. M. Burger and M. F. Massoglia Nov. 1976 328 p refs 2 Vol.
(Contract NSF C-76-17165)
(PB-263683/5; NSF/RA-760413) Avail: NTIS HC A15/MF A01 CSCL 05B

Ten Research Applied to National Needs (RANN) projects are reported. Subject areas include: (1) creating and evaluating an experimental industry-university furniture R and D applications institute; (2) innovation centers; (3) the less cash/less check society: an indepth technology assessment; (4) urban technology system; (5) energy absorption characteristics of structural systems subjected to earthquakes excitation; (6) metromex; (7) the Texas Energy Advisory Council; (8) tertiary oil recovery; (9) assessment of a new textile technology; and (10) automated bending system for the fabrication of ship frames. GRA

N77-25028# Shosteck (Herschel) Associates, Silver Spring, Md.
AN EVALUATION OF THE FACTORS INFLUENCING SUCCESSFUL DIFFUSION AND APPLICATION OF SCIENTIFIC TECHNOLOGY UNDER THE STATE TECHNICAL SERVICES ACT Final Report
Herschel Shosteck Jan. 1977 65 p refs Sponsored in part by NBS
(PB-262763/6; HSA-000002) Avail: NTIS HC A04/MF A01 CSCL 05A

As originally mandated, the State Technical Services (STS) Act emphasized development of informational, referral, and educational services. The states found that effective technology transfer occurred only when field service agents promoted it through face-to-face contact with potential users. For such face-to-face contacts to succeed, it was necessary to seek out clientele groups with a problem amiable to solution through technology transfer. GRA

N77-25029# Bureau of Mines, Salt Lake City, Utah. Metallurgy Research Center.
USE OF SHREDDED AUTOMOBILE SCRAP FOR COPPER CEMENTATION
W. L. Staker and R. D. Groues 1976 20 p refs
(PB-263575/3; BM-RI-8198) Avail: NTIS HC A02/MF A01 CSCL 08I

The use of shredded automobile scrap for copper cementation was investigated. Air agitation was used to improve the cementation rate and prevent excessive buildup of copper on the iron. Pregnant solution was obtained from industrial leaching operations, processed in the test unit, and the barren solution and cement copper were returned to the plant process stream. The test results showed that the air agitated launder containing automobile scrap was an effective means for recovering copper from leach solutions. The most suitable scrap product was obtained from incinerated automobile hulks shredded in a hammer-type shredder. GRA

N77-25030# Public Technology, Inc., Washington, D. C.
TRANSPORTATION PLANNING AND IMPACT FORECASTING TOOLS Final Report, Jan. - Oct. 1976
Beth Irons French and Ellen McCarthy Casebeer Oct. 1976 40 p refs
(Contract DOT-OS-60076)
(PB-263963/1; DOT-TST-77-10) Avail: NTIS HC A03/MF A01 CSCL 13B

Tools, both automated and manual for transportation planning and analysis are examined. Specific emphasis is given to the

Urban Transportation Planning Systems package, its features and its application. An extensive list of contacts and an annotated bibliography are provided, including coverage of transportation planning models, land use models, and major impact assessments. GRA

N77-25031# Urban Inst., Washington, D.C.
USING AN IMPACT MEASUREMENT SYSTEM TO EVALUATE LAND DEVELOPMENT Final Report
Phillip S. Schaenman Sep. 1976 111 p refs
(Contract DC-PD-51)
(PB-263780/9; URI-15500; LC-76-43199; ISBN-87766-172-3) Avail: NTIS HC A06/MF A01 CSCL 13B

Practical ways for urban planners to assess the impacts of land development on a local economy, the environment, public and private services, and aesthetic, cultural and social conditions of a community are identified. Where possible, impacts are described in terms of end results to people. The state of the art of practical measurement procedures available are identified, and an illustrative system of measures for assessing impacts of proposed developments is set forth, identifying data collection and analyses procedures for each measure. GRA

N77-25032# Raytheon Co., Portsmouth, R. I.
SELECTED APPLICATIONS OF INSTRUMENTATION AND AUTOMATION IN WASTEWATER-TREATMENT FACILITIES Final Report, 30 Jan. 1972 - 31 May 1975
Allen E. Moluar Dec. 1976 315 p refs
(Contract EPA-68-03-0144)
(PB-263777/5; EPA-600/2-76-276) Avail: NTIS HC A14/MF A01 CSCL 13B

The application of modern control systems to the operation of wastewater-treatment plants is discussed. Control strategies for the commonly used wet- and dry-weather treatment processes and their collection systems are described. Wherever possible, the benefits derived from, as well as the operating problems associated with, the actual or proposed control strategies are documented. Cost/benefit analysis indicates that many untried feed forward mass proportional control schemes are economically attractive because of the low payback periods. GRA

88 SPACE SCIENCES (GENERAL)

N77-25033*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYSIS OF ABLATION DEBRIS FROM NATURAL AND ARTIFICIAL IRON METEORITES
M. B. Blanchard and A. S. Davis (San Jose State Univ., Calif.) May 1977 33 p refs
(NASA-TM-X-73232; A-7000) Avail: NTIS HC A03/MF A01 CSCL 03B

Artificial ablation studies were performed on iron and nickel-iron samples using an arc-heated plasma of ionized air. Experiment conditions simulated a meteoroid traveling about 12 km/sec at an altitude of 70 km. The artificially produced fusion crusts and ablation debris show features very similar to natural fusion crusts of the iron meteorites Boguslavka, Norfork, and N'Kandhla and to magnetic spherules recovered from Mn nodules. X-ray diffraction, electron microprobe, optical, and scanning electron microscope analyses reveal that important mineralogical, elemental, and textural changes occur during ablation. Some metal is melted and ablated. The outer margin of the melted rind is oxidized and recrystallizes as a discontinuous crust of magnetite and wustite. Adjacent to the oxidized metallic ablation zone is an unoxidized metallic ablation zone in which structures such as Widmannstatten bands are obliterated as the metal is transformed to unequilibrated alpha 2 nickel-iron. Volatile elements are vaporized and less volatile elements undergo fractionation. Author

N77-25034# Academy of Sciences (USSR), Moscow. Space Research Inst.
THE LATEST INVESTIGATIONS OF CETI IN THE USSR
N. S. Kardashev 1976 24 p refs
(PR-279) Avail: NTIS HC A02/MF A01

The strategy for finding signals from extraterrestrial civilizations is discussed. Arguments are given that only supercivilization finding is expedient. Experiments conducted in the USSR are described in brief. Author (ESA)

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-25035*# Agence Tunisienne de Public-Relations, Tunis.
DETERMINATION OF THE ZERO POINTS AND THE PERIODIC ERRORS IN THE STAR CATALOGS
D. P. Duma Washington NASA Jun. 1977 181 p refs Transl. into ENGLISH of the book "Opredeleniye nul-punktov i periodicheskikh pogreshnostey zvezdnykh katalog" Kiev, Naukova Pumka Press, 1974 p 1-163 Sponsored in part by NASA
(Contract NSF C-504)
(NASA-TT-F-16279) Avail: NTIS HC A09/MF A01 CSCL 03A

The best known methods for determining the zero points and periodic errors in star catalogs based on observations of the sun, moon, planets and scientific satellites are explained, analyzed, and compared. Author

N77-25036# Air Force Geophysics Lab., Hanscom AFB, Mass. Optical Physics Div.
THE AFGL FOUR COLOR INFRARED SKY SURVEY: CATALOG OF OBSERVATIONS AT 4.2, 11.0, 19.8 AND 27.4 MICROMETERS Interim Report
Stephan D. Price and Russell G. Walker 17 Sep. 1976 155 p refs
(ARPA Order 1366; AF Proj. 7670)
(AD-A034448; AFGL-TR-76-0208; AFGL-ERP-576) Avail: NTIS HC A08/MF A01 CSCL 17/5

The results of a multicolor infrared survey conducted by the Air Force Geophysics Laboratory are reported. Observations, in one or more broad band colors at effective wavelengths of 4.2, 11.0, 19.8, and 27.4 micrometers are presented with positions for 2363 sources. Ninety percent of the celestial sphere has been surveyed at 11.0 micrometers and about two thirds of this area was covered more than once. Author (GRA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N77-25037# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ORIGIN OF THE SOLAR SYSTEM
Hannes Alfven Apr. 1976 57 p refs Part 1 and 2 presented at the 100th Anniv. of the John Hopkins Univ., Baltimore, Feb. 1976 and Part 3 and 4 at the Conf. on The Origin of the Solar Syst., Newcastle, Engl., Apr. 1976
(TRITA-EPP-76-08) Avail: NTIS HC A04/MF A01

The methodology of the problem of the origin and evolution of the solar system was analyzed; it is pointed out that it can be approached in two different ways: by mythology and by actualism. The Laplacean type of theories based on a disk as an intermediate state is considered. The band structure is explained as a result of the ionization of infalling matter when its velocity has reached the critical velocity for ionization. It is shown that the position and the structure of the groups of planets and satellites is completely defined by two parameters: mass of central body, and spin of central body. This gives the complete matrix of the groups of bodies. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-25038*# Houston Univ., Tex. Dept. of Geology.
CLOSURE AND RATIO CORRELATION ANALYSIS OF LUNAR CHEMICAL AND GRAIN SIZE DATA Final Report
John C. Butler [1976] 50 p refs
(Grant NsG-7198)
(NASA-CR-153063) Avail: NTIS HC A03/MF A01 CSCL 03B

Major element and major element plus trace element analyses were selected from the lunar data base for Apollo 11, 12 and 15 basalt and regolith samples. Summary statistics for each of the six data sets were compiled, and the effects of closure on the Pearson product moment correlation coefficient were investigated using the Chayes and Kruskal approximation procedure. In general, there are two types of closure effects evident in these data sets: negative correlations of intermediate size which are solely the result of closure, and correlations of small absolute value which depart significantly from their expected closure correlations which are of intermediate size. It is shown that a positive closure correlation will arise only when the product of the coefficients of variation is very small (less than 0.01 for most data sets) and, in general, trace elements in the lunar data sets exhibit relatively large coefficients of variation. Author

N77-25039*# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
STRATIGRAPHY AND TECTONICS OF SOUTHEASTERN SERENITATIS Ph.D. Thesis
Theodore Allen Maxwell Dec. 1976 142 p refs
(Grant NsG-7090)
(NASA-CR-153218) Avail: NTIS HC A07/MF A01 CSCL 03B

Results of investigations of returned Apollo 17 samples, and Apollo 15 and 17 photographs have provided a broad data base on which to interpret the southeastern Serenitatis region of the moon. Although many of the pre-Apollo 17 mission interpretations remain valid, detailed mapping of this region and correlation with earth-based and orbital remote-sensing data have resulted in a revision of the local mare stratigraphy. Author

N77-25040# Academy of Sciences (USSR), Moscow. Space Research Inst.
INFRARED THERMAL MEASUREMENTS FROM THE ARTIFICIAL SATELLITES OF VENUS
L. V. Ksanfomality 1976 12 p refs
(D-226) Avail: NTIS HC A02/MF A01

Thermal radiation measurements of the Venus atmosphere from Venera 9 and 10 space vehicles are reported. The altitude of the upper cloud layer which emits the radiation received by radiometers was found to be 64 to 67 km, based on the brightness temperature obtained in the experiment by means of the available model of the Venus atmosphere. Further conclusions were reached regarding daytime and nighttime temperature. ESA

N77-25041# Academy of Sciences (USSR), Moscow. Space Research Inst.
MARS: PLASMA ENVIRONMENT
O. L. Vaisberg 1976 51 p refs Presented at the Intern. Symp. on Solar Terrest. Phys., Boulder, Colo., 7-18 Jun. 1976
(D-234) Avail: NTIS HC A04/MF A01

Data and the results of plasma measurements onboard Mars 2, 3, and 5 by means of two different instruments are reviewed. The characteristics of the Martian bow shock appear to be similar to those of the terrestrial bow shock. Mean areocentric height of the bow shocks subsolar point is about 1,500 km above the surface of Mars. A boundary layer was shown to exist near Mars in the region of mass-exchange between the solar wind plasma and the planet, and is detailed. Data on plasma parameters inside the Martian tail where no steady ion flow was observed are not complete and suggest an existence of sporadic, directed ion fluxes with energies from a few tens of eV to several keV and also an existence of cold plasma with number density up to 20 to 30/cu cm. Author (ESA)

N77-25042# Academy of Sciences (USSR), Moscow. Space Research Inst.
THE MAP OF DIELECTRIC CONSTANT OF THE MARTIAN SURFACE LAYER
N. N. Kroupenio 1976 11 p refs
(PR-275) Avail: NTIS HC A02/MF A01

A dielectric constant map was made using the radio-physical experiment data from the automatic interplanetary stations Mars 3 and Mars 5 at 3.4 cm wavelength, and by the ground radar measurement data 1965 to 1971 at 3.8 cm and 12.5 cm wavelength. The minimum linear resolution of surface is 70 km. The map was made for five gradations of the dielectric constant: less than 2.1; 2.1 to 2.7; 2.7 to 3.4; 3.4 to 4.2; greater than 4.2 corresponding to the following gradations of the soil density value: less than 0.9; 0.9 to 1.3; 1.3 to 1.7; 1.7 to 2.1; greater than 2.1 g/cu cm. The dielectric constant data relate to the upper Martian ground layer (up to 2m average). Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-25043*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY BASELINE OBSERVATIONS OF TYPE 3 SOLAR RADIO BURSTS
Richard R. Weber, R. J. Fitzenreiter, J. C. Novaco, and J. Fainberg Apr. 1977 22 p refs Submitted for publication
(NASA-TM-X-71319; X-692-77-90) Avail: NTIS HC A02/MF A01 CSCL 03B

Simultaneous observations of type III radio bursts using spacecraft separated by several tenths of an AU were made using the solar orbiters HELIOS-A and -B. The burst beginning at 1922 UT on March 28, 1976, was located from the intersection of the source directions measured at each spacecraft, and from the burst arrival time differences. Wide baseline observations give the radial distance of the source at each observing frequency. Consequently, coronal electron densities and exciter velocity were determined directly, without the need to assume a density model as is done with single spacecraft observations. The separation of HELIOS-A and -B also provided the first measurements of burst directivity at low frequencies. For the March 28 burst, the intensity observed from near the source longitude (HELIOS-B) was significantly greater than from 60 W of the source (HELIOS-A). Author

N77-25044# Lockheed Missiles and Space Co., Palo Alto, Calif.
NORTH-SOUTH ASYMMETRY AND ANISOTROPY OF SOLAR COSMIC RAYS DURING THE APRIL 18, 1972 FLARE
T. A. Ivanova, S. N. Kuznetsov, Iu. I. Logachev, and E. N. Sosnovets [1976] 5 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 14, no. 2, 1976 p 235-238
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Simultaneous measurements of solar cosmic ray protons with E sub p approximately 1 Mev in earth's magnetosphere over the polar caps on the Cosmos-480 and in the transition region on the Prognoz during the April 18, 1972 flare are compared. A sharp anisotropy in the solar cosmic ray proton flux with maximum intensity near a plane perpendicular to the earth-sun line was observed outside the magnetosphere for not less than approximately 10 hours. The proton flux over the southern and northern polar caps hence agreed, respectively, with the maximum and minimum fluxes recorded in the transition region. The results favor the possibility of prolonged reconnection of the lines of force of the terrestrial and interplanetary magnetic fields. Author

N77-25045# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
LABORATORY SIMULATION OF EROSION BY SPACE PLASMA
L. Kristoferson and Kerstin Fredga Apr. 1976 33 p refs
(TRITA-EPP-76-06) Avail: NTIS HC A03/MF A01

A laboratory experiment was made in which a plasma stream collides with targets made of different materials of cosmic interest. The experiment can be viewed as a process simulation of the solar wind particle interaction with solid surfaces in space, e.g. cometary dust. Special interest is given to sputtering of OH and Na. It is shown that the erosion of solid particles in interplanetary space at large heliocentric distances is most likely dominated by sputtering and by sublimation near the sun. The heliocentric distance of the limit between the two regions is determined mainly by the material properties of the eroded surface, e.g. heat of sublimation and sputtering yield, a typical distance being 0.5 a.u. It is concluded that the observations of Na in comets at large solar distances, in some cases also near the sun, is most likely to be explained by solar wind sputtering.
Author (ESA)

N77-25046# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
INTERPRETATION OF LABORATORY EXPERIMENTS OF INTEREST TO SPACE PHYSICS
Lars P. Block Jun. 1976 16 p refs Presented at the Am. Geophys. Union Intern. Symp. on Solar-Terrest. Phys., Boulder, Colo., 7-18 Jun. 1976
(TRITA-EPP-76-13) Avail: NTIS HC A02/MF A01

The merits and limitations of experiments designed for studies of solar wind interaction with magnetospheres (terrella experiments) and nonmagnetized bodies, neutral lines and sheets, wave particle interactions, anomalous resistivity, double layers, magnetically field-aligned electric fields in strong magnetic mirrors, and the critical ionization velocity of a plasma moving through natural gas are discussed.
Author (ESA)

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-25047*# Alabama Univ., Huntsville. School of Science and Engineering.
THE SPECIFIC LIGHT OUTPUT OF CESIUM IODIDE CRYSTALS Final Technical Report, 26 Jun. 1969 - 31 Dec. 1976
John C. Gregory 31 Dec. 1976 82 p refs
(Contract NAS8-24953)
(NASA-CR-150267; UAH-RR-200) Avail: NTIS HC A05/MF A01 CSCL 03B

Large area ion chambers for a high energy cosmic ray experiment, scintillating plastic fibers as light pipes for a cosmic ray hodoscope, and an evaluation of clad scintillating light pipes were considered. For individual titles, see N77-25048 through N77-25050.

N77-25048*# Alabama Univ., Huntsville.
LARGE AREA ION CHAMBERS FOR A HIGH ENERGY COSMIC RAY EXPERIMENT
In its The Specific Light Output of Cesium Iodide Crystals 31 Dec. 1976 p 1-44 (For primary document see N77-25047 15-93)
Avail: NTIS HC A05/MF A01 CSCL 03B

High resolution measurement of the iron group nuclei was performed with the intention of determining individual abundances in the cosmic ray flux at the earth of particles with z = 22 to 30. Of the three types of dE/dx detectors used in the experiment, pulse ion chambers, Cerenkov radiators and scintillators, the first has the best z resolution over a wide range of particle z and energy. The plastic scintillators define the particle acceptance cone of the telescope while the Cerenkov detector aids in rejection of low energy particle background and measurement of particle velocity.
Author

N77-25049*# Alabama Univ., Huntsville.
SCINTILLATING PLASTIC FIBERS AS LIGHT PIPES FOR A COSMIC RAY HODOSCOPE: FEASIBILITY CALCULATIONS AND MEASURED ATTENUATION CHARACTERISTICS
In its The Specific Light Output of Cesium Iodide Crystals 31 Dec. 1976 p 45-58 refs (For primary document see N77-25047 15-93)
Avail: NTIS HC A05/MF A01 CSCL 03B

A candidate hodoscope uses arrays of scintillator fibers, followed by an image intensifier and imaging system such as that proposed for the X-ray shadowgraph. A literature search was performed to ascertain the experience of other workers with hodoscopes using this or similar principles. Calculations were performed to determine the feasibility of candidate systems and some laboratory experiments were performed to attempt to check these numbers.
Author

N77-25050*# Alabama Univ., Huntsville.
EVALUATION OF CLAD SCINTILLATING LIGHT PIPES
In its The Specific Light Output of Cesium Iodide Crystals 31 Dec. 1976 p 59-63 (For primary document see N77-25047 15-93)
Avail: NTIS HC A05/MF A01 CSCL 03B

Arrays of fibers made of scintillating material were used as position-sensitive detectors or hodoscopes for beam-finding at ion accelerators. Experiments were made with alpha's from an Am241 source incident upon one end of the fiber, the other end being viewed with a photomultiplier tube. The scintillation light was not detected in any of the fibers tested beyond about 5 cm. The effective useful lengths for detection of relativistic heavy ions were given.
Author

N77-25051*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STUDIES OF TRANSIENT X-RAY SOURCES WITH THE ARIEL 5 ALL-SKY MONITOR Ph.D. Thesis - Maryland Univ.
Louis Joseph Kaluzienski May 1977 251 p refs
(Grant NGR-21-002-316)
(NASA-TM-X-71321; X-661-77-107) Avail: NTIS HC A12/MF A01 CSCL 03B

The All-Sky Monitor, an imaging X-ray detector launched aboard the Ariel 5 satellite, was used to obtain detailed light curves of three new sources. Additional data essential to the determination of the characteristic luminosities, rates of occurrence (and possible recurrence), and spatial distribution of these objects was also obtained. The observations are consistent with a roughly uniform galactic disk population consisting of at least two source sub-classes, with the second group (Type 2) at least an order of magnitude less luminous and correspondingly more frequent than the first (Type 1). While both subtypes are probably unrelated to the classical optical novae (or supernovae), they are most readily interpreted within the standard mass exchange X-ray binary model, with outbursts triggered by Roche-lobe overflow (Type 1) or enhancements in the stellar wind density of the companion (Type 2), respectively.
Author

N77-25052# West Florida Univ., Pensacola.
DOSIMETRIC CLASSIFICATION OF MIXED BEAMS OF COSMIC RAY HEAVY NUCLEI IN SPACE Interim Report, Jan. - Sep. 1976
Hermann J. Schaefer 15 Oct. 1976 17 p refs
(Contract N00014-76-C-0544; NR Proj. 105-860)
(AD-A034205; IR-1) Avail: NTIS HC A02/MF A01 CSCL 03/2

Heavy nuclei of the primary galactic radiation in space can have the same linear energy transfer (LET) yet greatly different energy distribution patterns in the microstructure of tissue. Therefore, the LET distribution as it is commonly used for dosimetric classification of mixed beams of conventional nuclear radiations is inadequate for heavy particles. The study proposes to replace, for heavy particles, the LET distribution by the energy density (ED) distribution. The formalism for establishing the ED distribution is derived, and the distributions by volume and energy are presented for two complementary mixed beams of Z = 26

particles with energy spectra from zero to 70 and from 70 to 760 Mev/nucleon. It is shown that both types discriminate well the two different energy spectra. Which type would reflect more accurately the differences in biological effectiveness can only be decided by comparative experiments. Author

N77-25053# Air Force Weapons Lab., Kirtland AFB, N.Mex.
SKYLAB 2: RADIATION DOSIMETRY SYSTEMS AND FLIGHT RESULTS Final Report
Glenn C. Ainsworth, Marion F. Schneider, Joseph F. Janni, and Andrew D. Grimm Sep. 1976 107 p refs
(AD-A032409; AFWL-TR-73-222) Avail: NTIS HC A06/MF A01 CSCL 18/4

Instrumentation to measure the radiobiologically significant high energy radiations encountered in manned spaceflight is of fundamental importance in ensuring astronaut safety and the ultimate mission success of these space programs. Since the discovery of high energy radiations in space, it has been recognized that manned operations in space would require a very careful consideration of these radiations. To date, manned space operations have not encountered dangerous radiation levels, either because of the absence of high energy solar particles, the avoidance of the areas of high fluxes of trapped particles in the earth's magnetosphere, and the relatively short duration of missions where high fluxes were encountered. However, on future long-term missions the reduction of radiation exposure may be more difficult, and a very comprehensive measurement of radiation levels must be made. This report describes an advanced active dosimetry system that will measure the important radiations encountered within a manned spacecraft. GRA

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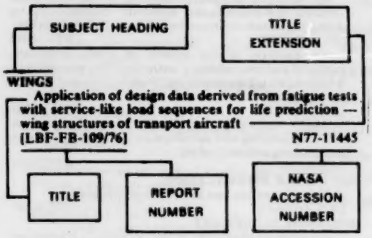

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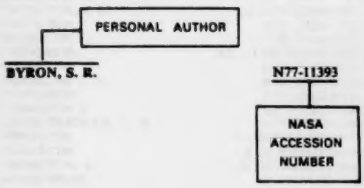

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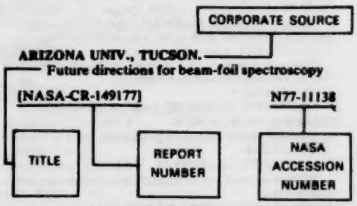

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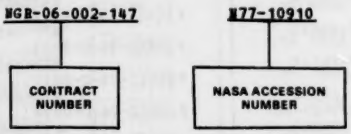

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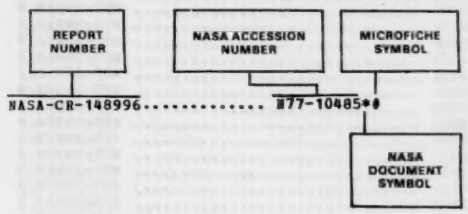

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WADC-76359-30 ..... N77-24281 #
WADC-76361-30 ..... N77-24302 #

WAEC-GSED-106 ..... N77-24280 #

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WASA-CASE-ARC-10915-3 ..... N77-24200*#
WASA-CASE-ARC-10975-1 ..... N77-24771*#
WASA-CASE-ARC-10984-1 ..... N77-24328*

WASA-CASE-GSC-12077-1 ..... N77-24455*

WASA-CASE-LAR-11745-1 ..... N77-24339*#
WASA-CASE-LAR-12045-1 ..... N77-24423*

WASA-CASE-LEW-12131-1 ..... N77-24498*#
WASA-CASE-LEW-12542-1 ..... N77-24254*#
WASA-CASE-LEW-12569-1 ..... N77-24496*#
WASA-CASE-LEW-12775-1 ..... N77-24589*#
WASA-CASE-LEW-12791-1 ..... N77-24385*#
WASA-CASE-LEW-12819-1 ..... N77-24593*#

WASA-CASE-MFS-23620-1 ..... N77-24497*#

WASA-CASE-MSC-12709-1 ..... N77-24375*
WASA-CASE-MSC-14840-1 ..... N77-24331*
WASA-CASE-MSC-16098-1 ..... N77-24755*#

WASA-CASE-NPO-13448-2 ..... N77-24469*#
WASA-CASE-NPO-13641-1 ..... N77-24340*#
WASA-CASE-NPO-13676-1 ..... N77-24781*#
WASA-CASE-NPO-13808-1 ..... N77-24456*#
WASA-CASE-NPO-13921-1 ..... N77-24590*#
WASA-CASE-NPO-13982-1 ..... N77-24341*#
WASA-CASE-NPO-13993-1 ..... N77-24468*#
WASA-CASE-NPO-14022-1 ..... N77-24338*#

WASA-CR-2843 ..... N77-24306*#
WASA-CR-2845 ..... N77-24728*#
WASA-CR-127679 ..... N77-24133*#
WASA-CR-135035 ..... N77-24332*#
WASA-CR-135128 ..... N77-24188*#
WASA-CR-137827 ..... N77-24457*#
WASA-CR-145107 ..... N77-24082*#
WASA-CR-145108 ..... N77-24083*#
WASA-CR-145109 ..... N77-24084*#
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WASA-CR-145167 ..... N77-24097*#
WASA-CR-145186 ..... N77-24153*#
WASA-CR-145189 ..... N77-24074*#
WASA-CR-145194 ..... N77-24057*#
WASA-CR-150263 ..... N77-24780*#
WASA-CR-150267 ..... N77-25047*#
WASA-CR-150269 ..... N77-24160*#
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WASA-CR-150274 ..... N77-24383*#
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WASA-CR-151338 ..... N77-24887*#
WASA-CR-151362 ..... N77-24802*#
WASA-CR-151955 ..... N77-24343*#
WASA-CR-151960 ..... N77-24055*#
WASA-CR-151984 ..... N77-24342*#
WASA-CR-151985 ..... N77-24563*#
WASA-CR-151986 ..... N77-24564*#
WASA-CR-151998 ..... N77-24287*#
WASA-CR-152509 ..... N77-24165*#
WASA-CR-152514 ..... N77-24170*#
WASA-CR-152515 ..... N77-24171*#
WASA-CR-152516 ..... N77-24690*#
WASA-CR-152517 ..... N77-24691*#
WASA-CR-152518 ..... N77-24692*#
WASA-CR-152519 ..... N77-24334*#
WASA-CR-152522 ..... N77-24335*#
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WASA-CR-152524 ..... N77-24989*#
WASA-CR-152667 ..... N77-24559*#
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WASA-CR-152848 ..... N77-24562*#
WASA-CR-152851 ..... N77-25008*#
WASA-CR-152955 ..... N77-24602*#
WASA-CR-153001 ..... N77-24978*#
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WASA-CR-153008 ..... N77-24162*#
WASA-CR-153009 ..... N77-24561*#
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WASA-CR-153204 ..... N77-24384*#
WASA-CR-153205 ..... N77-24686*#
WASA-CR-153206 ..... N77-24333*#
WASA-CR-153207 ..... N77-24981*#
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WASA-CR-153217 ..... N77-24424*#
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WASA-SP-8119 ..... N77-24191*#

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WASA-TM-X-3514 ..... N77-24250*#
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NASA-TT-F-16777 ..... N77-24466*#
NASA-TT-F-17421 ..... N77-24208*#
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NBS-TN-690 ..... N77-24327 #
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NBSIR-76-1174 ..... N77-24511 #
NBSIR-76-1191 ..... N77-24669 #
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NOAA-TR-ERL-379 ..... N77-24751 #

NOAA-TR-NWS-20 ..... N77-24746 #

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NOAA-76122301 ..... N77-24655 #
NOAA-76122903 ..... N77-24750 #
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NOAA-76122913 ..... N77-24446 #
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NRL-MR-3365 ..... N77-24951 #
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NSF/PRA-7420198/2/7-VOL-2 ..... N77-25003 #
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